Industrial Waste Diversion Program

Final Reports #11

CASE STUDIES OF THE 3RS ACTIVITIES OF "ON-SITE" COMPANIES IN ONTARIO

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INDUSTRIAL WASTE DIVERSION PROGRAM

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Report Prepared For:

Waste Management Branch
Ontario Ministry of the Environment

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CASE STUDIES OF THE 3RS ACTIVITIES OF "ON-SITE" COMPANIES IN ONTARIO

Report Prepared For:

Waste Management Branch
Ontario Ministry Of The Environment

In Consultation With:

Energy Pathways Inc.

Report Prepared By:

Energy Pathways Inc.

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DISCLAIMER

This report is in partial fulfillment of conditions of a grant given to Energy Pathways Inc. by the Ministry of the Environment under the Industrial Waste Diversion Program. The report was prepared by Energy Pathways Inc. and documents results of work for which the Ministry of the Environment provided financial assistance.

The views and ideas expressed in this report are those of the authors and do not reflect necessarily the views and policies of the Ministry of the Environment, nor does mention of trade names or commercial products constitute endorsement or recommendation for use.

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1.0 INTRODUCTION

This report presents case studies of the 4Rs activities of 14 Ontario companies in a variety of industrial sectors. The report is intended to provide the Ontario Ministry of the Environment (MOE) with a 'snapshot' overview of the successes and failures of various 4Rs waste management applications undertaken by a selection of firms across the province.

In developing these case studies, Energy Pathways Inc. (EPI) has drawn on its good relations with companies that have been involved with the ON-SITE program. These good relationships have allowed EPI to discuss and record the day-to-day 4Rs activities of individual firms, their past experiences with 4Rs options, and their future plans. The companies provided information voluntarily, and in all cases reserved the right to withold confidential or proprietary information.

Although most company representatives do not use the standard 4Rs terminology, their actions are demonstrating an economic, if not a semantic appreciation of this form of process and waste control. To the companies described in the following case studies, the "4RS" are simply another aspect of good business practice.

2.0 SCOPE OF WORK AND METHODOLOGY

In September and December 1988, EPI submitted to the MOE a total of 60 one-page assessments which detailed the 4Rs activities of 1988 ON-SITE companies. These assessments briefly summarized the waste management concerns, 4Rs activities and future plans of companies in a wide range of industrial sectors.

Of the 60 companies that were assessed, a number were not suitable for further study. Some ON-SITE companies were focussing on occupational health and safety, energy conservation, or waste treatment projects rather than on a 4Rs approach to waste management. From the 60 short appraisals, the MOE selected for more detailed study a total of 14 companies involved in 4Rs activities in some way.

EPI provided these 14 companies with a waste management research questionnaire, which then became the basis for discussions between EPI personnel and company representatives.

In developing the final case studies, EPI also used two-page 4Rs Project Summary sheets completed by the companies, which described individual 4Rs projects in more detail, reviewing the problem identified, solutions/approaches investigated, the approach chosen, and results and impacts of the new approach. The ON-SITE workers' bi-weekly progress reports, internal company reports and memos and interviews with the companies' past or present ON-SITE worker(s) were other sources of information.

The information gathered from these sources is summarized in the following anonymous case studies. In each case, copies of the questionnaire are also provided.

PAINTS AND CHEMICALS

4Rs CASE STUDY: A1

PAINT MANUFACTURER

COMPANY CONCERNS

This manufacturer of consumer and industrial paints employs 110 people. It has four process lines: one for water-based consumer paints and three for solvent-based industrial paints. The industrial paints are drum, automotive and appliance enamels.

The company's major waste streams include cleaning solvents, wash water, off-spec product (reusable and non-reusable), semi-solid paint, pigment dust and packaging materials. For some of these wastes, the company already had 4Rs management solutions in place; for others, the ON-SITE worker investigated possible alternatives.

4Rs ACTIVITIES

Cleaning Solvents

Several types of cleaning solvents are used for cleaning the mixing vessels and the filling lines for the industrial paint lines. The solvents are predominantly a blend of xylene, toluene, MEK and MIBK.

For several years the company has used an off-site reclaimer, whose services cost $225,000 per year. After pricing other competitors, the company settled on a new reclaimer who now charges them $150,000 per year for solvent and off-spec paint solid reclamation services. The company purchases 4,000 gallons per month of reclaimed solvents and then sends the spent solvents back to the reclaimer for processing. The solvents are drummed and sent to the reclaimer unsegregated because the company does not have the space to keep them segregated. The new reclaimer charges 64 cents/gallon to pick up solvent and then sells reclaimed solvent back to the company for 95 cents/gallon. The recovery rate is between 70 and 80 per cent (losses occur due to absorption and evaporation).

The ON-SITE worker investigated on-site distillation and found that the company would need a still which would cost $200,000. Payback was estimated at two years. The decision to purchase a still has been deferred because the company is considering expansion plans. However, management now recognizes that solvents account for the largest component of their waste management costs.

A benefit of all the recent research into solvents has been that solvent use has decreased to two gallons of solvents per 100 gallons of product manufactured. No exact figure of previous consumption of cleaning solvent is available since not all solvents are used as cleaners; some are used as paint bases.

Nevertheless, over the last three years, solvent purchases have declined even though production has increased.

Wash Water
Wash water is generated during washing of the consumer paint lines and mixing vessels. The wash water has always been reused until it becomes too saturated with paint to be of any further use as a cleaner. It is then stored and used as the base for water-based consumer paints. In this way, wash water does not have to be treated or disposed of.

Off-Spec Paint (Reusable)
Off-spec paint is divided into two types: that which can be reused in new paint, and that which has to be disposed of. If reusable, the off-spec paint is stored until a compatible paint is being run, and is then inserted into the batch. Designated technicians are responsible for monitoring the plant's off-spec inventory and ensuring its rapid reuse. Some 4,000 gallons of off-spec paint are in-house at any given time; up to 90% of this will be reused.

Off-Spec Paint (Non-reusable)
The remaining 10% of off-spec paint is usually composed of extra quantities of special blend paints which are returned by customers. This paint is sent to the company's solvent reclaimer at a cost to the paint manufacturer of $1.10 per gallon. On occasion, the non-reusable paint is sent to Varnicolor's "barn paint" program which blends and donates the paint to charities. However, the company rarely produces sufficient volumes to make this worthwhile.

A small fraction of non-reusable paint is produced by the company's three spray booths which are used to spray samples for customers' use. This paint is sent to a disposal company which was recommended by the ON-SITE worker. (The company's former waste disposal company charged more for its services.)

Semi-solid Paint
The company generates 200 drums of semi-solid paint each year. This material is predominantly composed of returned goods and spill cleanup material from in-house processes. The company is reluctant to send this paint to landfill because it costs $500/drum to do so. Instead, waste solvent is added to the paint, making it pumpable. Once this is done, the material is sent to the solvent reclaimer and distilled at a cost of $1.19/gallon.

In-plant paint spill cleanup material is another source of semi-solid paint. The company was using sawdust to absorb paint spills, but the local landfill refused to accept this combination of flammable substances. The company now combines spilled paint with clay. To date, quantities large enough to require disposal have not been accumulated.

Pigment Dust
Pigment dust is collected by an air containment system. Maintenance personnel empty a collection bag which is located below the system's filter into a 45 gallon drum. Dust is collected at a rate of five to ten drums per year.

Previously, this material was stored, but it is now being reused in the manufacture of primers where colour is not a concern.

Packaging Materials
In response to a municipal landfill ban on OCC, the company began segregating their OCC and sending it to the regional recycling centre.

The municipality also began rejecting the company's pigment bags because of pigment contamination. The bags are not registerable under Regulation 309, so one alternative for the company was to clean the bags out and send them to the recycling centre. However, the centre refused to take bags which had carried lead or chromium-containing pigments.

The company arranged to have their pigment supplier take these lead and chromium contaminated bags back, but it cleans all others and send them to the recycling centre.

The company also receives pigments in liquid form, packed in steel cans. During the last year, the company has begun reusing the cans in-house to store reusable off-spec paint. Previously, the company collected off-spec paints in large drums. This resulted in an unusable mixture of paints which required disposal. The company now saves the purchase price of the drums and the cost of their disposal. In addition, wooden pallets are now being segregated and the company is currently trying to locate pallet recyclers.

WASTE MANAGEMENT RESEARCH QUESTIONNAIRE

PART ONE: GENERAL INFORMATION

Name: (A1)
Title: SAFETY CO-ORDINATOR
Company:
Address:
# of Employees: 110
Principal Products/Services: PAINTS AND COATINGS

Type of Waste & Quantities: SOLVENT-WASH - 4000 Gal/month PIGMENT DU
WASH WATER OFFSPEC PAINT, SEMI-SOLID PAINT (200 DRUMS/YR)
Type of Disposal: SOLVENT RECLAIMER, RECYCLING

1. What sources of information on environmental and waste management **regulations** does the company use (e.g., in-house expertise, consultants, provincial government, etc.)?
   REGION, O.W.M.E.

2. What sources does the company turn to for information on **technologies** for the reduction of wastes and emissions (e.g., in-house expertise, consultants, provincial government, etc.)?
   REGION, O.W.M.E., O.W.M.C.

3. How many engineers are on staff at the plant site? 2

   Of these, how many have the time and mandate to work on controlling wastes at the plant (other than the ON-SITE worker)? 0

4. a. How many other staff with some technical training have the time and mandate to work on controlling wastes? 0

   b. Briefly describe their qualifications and roles in the company.

c. Does the company make use of waste management consultants?

___ Yes _X_ No

If yes, how often (full-time, part-time, once-only) _____

If not, why not? _____

5. What potential does the company think the various waste management approaches have for this plant?[1]

Reduction	✓	Good potential	__	Some potential	__	No potential
Reuse	✓	Good potential	__	Some potential	__	No potential
Recycling	✓	Good potential	__	Some potential	__	No potential
Recovery	__	Good potential	✓	Some potential	__	No potential
Treatment	__	Good potential	✓	Some potential	__	No potential
Disposal	__	Good potential	✓	Some potential	__	No potential

6. Does the company give the "4Rs" priority when looking at waste management solutions?

✓ Yes __ No

7. Would the company be willing to pay more for a "4Rs" solution than for treatment and/or disposal?

✓ Yes __ No

---

[1] Terms are defined as follows.
Reduction: not producing the waste in the first place, e.g., through process control or redesign, chemical substitution
Reuse: using a waste material, e.g., plastic regrind, again in its original form
Recycling: separating a waste material at source and reusing it, in the same process or in a different process
Recovery: removing materials from the mixed waste stream for sale or use off-site
Treatment: treatment on-site before discharge or disposal

4Rs CASE STUDY: B5

FIBRE MANUFACTURER

COMPANY CONCERNS

This synthetic fibre producer manufactures nylon for use in a variety of products, including carpeting, household utensils and wire coating. The nylon polymer is formed in long fibres, which can then be used as-is or chopped into chips for various uses.

This company had begun to undertake several 4Rs initiatives before the ON-SITE worker arrived. However, as a result of the efforts of the ON-SITE worker, an explicit 4Rs corporate policy was developed and implemented.

4Rs ACTIVITIES

4Rs Corporate Policy

Previously, this manufacturer had been using United States environmental standards to set corporate waste management policy. The ON-SITE worker prepared an overall environment and waste management policy for the company based on Canadian federal and Ontario provincial environment regulations. In particular, this corporate policy recognizes the increasing emphasis being given to the 4Rs, especially in Ontario. The ON-SITE worker was able to demonstrate to the company that 4Rs solutions can have economic benefits.

The ON-SITE worker carried out a comprehensive audit of wastes produced in the plant, and has focussed company attention on 4Rs alternatives for managing these wastes. A close working relationship has developed between the purchasing manager and the ON-SITE worker, who is now working full-time at the plant as a waste reduction coordinator. Whereas in the past, waste material was disposed of in the easiest way possible, virtually all waste material is now cleared through the coordinator and the purchasing department, to see if there could be another use for the material, either on-site or off. This policy has encouraged a significant number of 4Rs solutions to waste management problems.

Recycling of Polymer

The raw material used by this company in the production of nylon is a proprietary monomer, which is mixed in a product reaction vessel to form the nylon polymer. The process generates a large quantity of solid and liquid waste (the company considers the exact quantities to be proprietary information). This waste is handled in a number of ways depending on the nature of the waste and the potential for reuse.

Waste nylon polymer is reprocessed in a recycling reaction vessel, where it is returned to a monomer which can be mixed with virgin material to make new nylon polymer. The company accepts as much polymer waste from other companies as storage permits. At times when virgin monomer has been expensive or unavailable, the waste from other companies has kept them in production.

The company is now considering accessing another supply of waste polymer from off-site: a polymer/water mixture generated as a waste from tire manufacturing. The company has listed the need for such waste material on the Canadian Waste Materials Exchange.

Chemical Elimination Through Process Change

During the operation of the company's product reaction vessel, a solid cake would build up on the inner walls. This cake was made up of potassium permanganate ($KMnO_4$), calcium chloride (CaCl) and calcium hydroxide (CaOH) -- materials which had been introduced into the process to improve the quality of the polymer. When the reaction vessel was cleaned once a month with a 12 molar hydrochloric acid solution, a major waste stream was produced.

The company has now made a major change in the manufacturing process. Proprietary changes were made to the process in the reaction vessel, eliminating the need for $KMNO_4$, CaCl and CaOH. The source of the waste has now been eliminated without detriment to the quality of the end product, and hydrochloric acid is no longer needed for cleaning.

The change has had a number of benefits. The reaction vessel, which needed shutdown once a month, now requires cleaning only once every six months. This cleaning involves only water and the residue, which can now go to landfill, is minimal. Extra savings were realized by selling 450 gallons of stored, unused hydrochloric acid back to the supplier. Total capital costs were only $2,094.50, while the estimated savings in disposal and material costs are $40,995.50 annually. A payback period of 3 weeks was realized.

As well, 3,000 kg of extra materials left over from past practices, including $KMnO_4$ and activated carbon, were listed on the Canadian Waste Materials Exchange. These materials sold for $3,187.00.

The former cleaning method used for the reaction vessel had produced approximately 300 45-gallon drums of a mixture of hydrochloric acid and nylon scraps, which had been stored on-site. After testing, these wastes were neutralized with CaOH and solidified with sand, producing a waste with a stable pH which could be disposed of at the local landfill. This process also reduced the volume of the waste by 50%. Attempts were made to recycle as much nylon as possible, but it was found to be too poor in quality.

Oil Reuse
Compressor oil contaminated with nylon particles was at one time sent off-site for incineration. A change to procedure is now capturing 50% by volume of this waste for reuse in the plant. Oil contaminated with nylon is left to stand, to allow the nylon to settle out. The good oil is then removed from the top of the drum and reused. The remaining sludge is sent by certified hauler for disposal. In the first year of using this new procedure, the company has saved 20 drums of compressor oil at a price of $266.50 per drum.

Heat Transfer Fluid
Until recently, drums of used heat transfer fluid were sent to a receiver to be incinerated. Now, after the fluid is checked for possible PCB contamination (negative), it is sent back to the supplier for distillation and used as a credit towards future purchases. In the first shipment, 20 45-gallon drums were shipped back to the supplier, where the fluid was distilled. The supplier returned 18 drums (2 were consumed in the distillation process) plus an additional two drums of virgin fluid.

The company estimates that it saved at least $27,000 by recycling this fluid instead of purchasing 18 drums of new heat transfer fluid.

Solvent Wastes
Over the years, the cleaning of reaction equipment and other machinery had produced hundreds of drums of a variety of mixed used and spent solvents. Distillers would not accept the solvents and other degreasers because there were too many unknown contaminants in the waste. Consequently, the wastes had to be sent to receivers for incineration -- an expensive process.

A change in procedure within the plant has now produced a much more desirable waste product for a distiller. During cleanup and maintenance work, varsol is now separated from other degreasers. This varsol will now be accepted by a reclamation facility. Although the exact savings are not yet known, they are expected to be substantial.

Lubricating Oils
In the past, little attention was paid to keeping waste oil streams separate, and mixed oil wastes were sent off-site for use as fuel supplements or for general incineration. These wastes will now be dealt with at source much more efficiently. Through proper handling at point of generation, expensive lubricating oils will be separated from the other oily wastes so that they can be sent off-site for re-refining.

Freon Substitution
During one phase of production, refrigeration units called 'chillers', which contain freon 113, are used. The company is purchasing new chillers, which will use less harmful chemicals called CFC 11 or CFC 12. These chemicals are said to have an ozone breakdown efficiency of less than 0.1%, compared to the 50% to 70% from freon 113. While this may not, strictly speaking, be

4Rs activity, it is nevertheless a substitution with considerable environmental significance.

Scrap Metal
When machines are taken out of use through equipment changes or general maintenance work at the company, the scrap metal generated is all sent to a local scrap dealer. In 1988, this accounted for revenue of $1,500 on the exchange of 29 tonnes of scrap metal of various types and qualities. In addition, the company saved $479 in avoided landfill tipping fees (at $16.50/tonne).

Cardboard Scrap
As with many of the efforts being made by the company to find productive end uses for material leaving the plant, geography is a barrier. The company has found that, with the relatively small amount of cardboard waste being generated, it is difficult to find a broker who will haul and receive their cardboard scrap.

The OCC waste, which consists of regular cardboard box wastes and heavy duty cardboard tubings, constitutes up to 50% of the solid waste that the company sends to landfill. Both types of OCC have been listed on the Ontario Waste Exchange and local companies are being approached to consider pooling their OCC to draw broker interest.

Polyethylene Bags
At one time, virgin material was shipped to the facility from an affiliate company in polyethylene (PE) bags. When possible, these bags were reused to ship product back to the affiliated supplier, but this was frequently not possible since the bags were easily damaged. The supplier has since switched to larger, more durable 55-gallon cardboard drums, so the company no longer generates PE waste on an ongoing basis. However, the company has 1,200 PE bags left over as a result of the change. Although these could be easily landfilled, the company has chosen to list them on the Ontario Waste Exchange in order to continue its 4Rs initiatives.

Future Plans
The company plans to follow the just-completed waste audit with a more thorough materials balance of the facility. This is expected to shine light on other areas within the plant that could benefit from a 4Rs management approach.

WASTE MANAGEMENT RESEARCH QUESTIONNAIRE

PART ONE: GENERAL INFORMATION

Name: (B5)
Title: Environmentalist
Company:
Address:
# of Employees: 350
Principal Products/Services: carpet fibres, nylon chip

Type of Waste & Quantities: Raw material
Organics Garbage Inorganics
Type of Disposal: Landfill, incineration, recycling, biological treatment by municipal sewer treatment plant

1. What sources of information on environmental and waste management **regulations** does the company use (e.g., in-house expertise, consultants, provincial government, etc.)?
   On-Site placement, consultants, phone calls to M.O.E. local director, in-house expertise, Canadian Waste Materials exchange, attendance at waste reduction seminars, Membership in the Canadian Chemical Producers Association through sister company (get direct feed back)

2. What sources does the company turn to for information on **technologies** for the reduction of wastes and emissions (e.g., in-house expertise, consultants, provincial government, etc.)?
   in-house expertise, on-site placement worker, consultants built into new designs through engineering consultants.

3. How many engineers are on staff at the plant site? 7

   Of these, how many have the time and mandate to work on controlling wastes at the plant (other than the ON-SITE worker)? 2

4. a. How many other staff with some technical training have the time and mandate to work on controlling wastes? 10

   b. Briefly describe their qualifications and roles in the company.
   Proc. Eng. and Q.C. supervisor,
   BSC. Chemistry - head of labs and reaction vessels
   MSc. Biology - On-site placement - waste reduction, safety
   Safety supervisor - B.A.

c. Does the company make use of waste management consultants?

_x_ Yes ___ No

If yes, how often (full-time, part-time, once-only) ___part-time_____

If not, why not? _____

5. What potential does the company think the various waste management approaches have for this plant?[1]

Reduction	✓ Good potential	__ Some potential	__ No potential
Reuse	✓ Good potential	__ Some potential	__ No potential
Recycling	✓ Good potential	__ Some potential	__ No potential
Recovery	✓ Good potential	__ Some potential	__ No potential
Treatment	✓ Good potential	__ Some potential	__ No potential
Disposal	✓ Good potential	__ Some potential	__ No potential

6. Does the company give the "4Rs" priority when looking at waste management solutions?

✓ Yes __ No

7. Would the company be willing to pay more for a "4Rs" solution than for treatment and/or disposal?

✓ Yes __ No

---

[1] Terms are defined as follows.
Reduction: not producing the waste in the first place, e.g., through process control or redesign, chemical substitution
Reuse: using a waste material, e.g., plastic regrind, again in its original form
Recycling: separating a waste material at source and reusing it, in the same process or in a different process
Recovery: removing materials from the mixed waste stream for sale or use off-site
Treatment: treatment on-site before discharge or disposal

4 Rs CASE STUDY: C15

ORGANIC FIBRE MANUFACTURER

COMPANY CONCERNS

Organic chemicals and cellulose fibres are used in the production of this company's primary product, rayon. As the company's main facility is more than half a century old, it has seen numerous retrofits and design changes throughout the years due to product and technological advancement. This has complicated the company's ability to deal with the ever-growing concern over its liquid and gaseous waste streams. Nevertheless, with the help of an ON-SITE worker, the company has been investigating 4Rs alternatives to its waste management challenges.

4Rs ACTIVITIES

Sodium Sulphate Waste

In the production of rayon, large quantities of sodium sulphate are produced as a by-product. At this plant, about 2-3 times more $NaSO_4$ is produced than product. Approximately 400 tonnes of $NaSO_4$ is generated every week.

Most of this $NaSO_4$ is recovered in an on-site recovery facility. This company has been practising 4Rs for a long time: for 20 years this waste has been sold off-site to household detergent manufacturers as a benign filler. In hard economic times, the sale of this waste has been what kept the plant in operation! The small amount which is not recovered is lost in solution and becomes part of the general effluent; at present, the cost of retrieving this waste is prohibitively high.

Zinc in Effluent

A component of the effluent, zinc, is of major concern. The company considered an alternative to the virgin product now used in the production of rayon. However, after testing, it was found that there is, at this time, no replacement available. Consequently, the company is now focussing on zinc recovery options, and is in the process of studying what method of treatment and subsequent recovery is most suitable. A prospective buyer for the recovered zinc has been lined up.

Mercury in Effluent

Mercury is another heavy component of the effluent which is of concern. The origins of the mercury in the waste stream were at one time unknown, because the company does not use mercury as a primary material in the production of rayon. Ultimately, the mercury was found to be entering by three sources:

1) In the sulphuric acid being purchased from a supplier.

2) Contained in the caustic soda purchased from another supplier. The mercury is introduced to the caustic in a reaction cell during production.

3) In the cellulose raw material. Mercury is found in the herbicides and fungicides permeating the cellulose.

Considered separately, the amounts of mercury entering the plant from each of these sources would be negligible. Together, the quantity is considerable, and is a great concern to the company. The three supplier sources of the mercury have been approached with mixed results. The sulphuric acid supplier has offered to accept back any retrievable mercury for use in its facility when the rayon manufacturer introduces a metal recovery system. The installation of a scrubber system on the rayon manufacturer's stack (see below) may also be a method of recovering mercury.

This unusual situation emphasizes the need for a material or mass balance audit to take place in a company before any major integrated waste management plan is developed.

Carbon Disulphide Gas Emissions

Another major concern for the company is the considerable amount of carbon disulphide gas in its emissions. The company intends to install a scrubbing and recovery system as soon as possible and will approach the Ministry of the Environment's 4Rs Funding Program for help. A year-long bench model study has just been completed and will be submitted to the Ministry in the near future.

The company hopes to retrieve sulphides collected in the scrubber for use both on- and off-site. As noted above, the scrubber may also recover mercury.

Various Drum and Material Wastes

The ON-SITE worker helped in the auditing and disposition of approximately 300 drums of off-spec, out-of-date, surplus, and waste material. Uses were found for the materials in 50 of the drums on-site. At disposal costs of $200 per drum, this amounted to a saving of $10,000, plus an unknown saving in raw materials.

The remaining drums are being studied further, listed on the Ontario Waste Exchange, or are awaiting disposal. It should be noted that although the company has listed a number of items on both the Canadian and Ontario waste materials exchanges, they have not yet been able to find users for their wastes.

Future Plans

The company is prepared, with technical and financial assistance from the government, to make reduction and recycling of its waste streams a top priority. As was noted, the plant facility is old and in need of a major capital

expenditure in order to comply with today's emission standards. Wherever practical, the company will emphasize materials recycling or recovery in the improvements it undertakes.

WASTE MANAGEMENT RESEARCH QUESTIONNAIRE

PART ONE: GENERAL INFORMATION

Name: (C15)
Title: TECHNICAL SERVICES MANAGER
Company:
Address:
# of Employees:
Principal Products/Services: PRODUCTION OF RAYON FOR USE IN TEXTILES, DISPOSABLE CLOTHES, WIPES, etc.
Type of Waste & Quantities: Na SO4, ZINC, MERCURY, OFF-SPEC AND OLD CHEMICAL PRODUCT,
Type of Disposal: OFF SITE SALES,

1. What sources of information on environmental and waste management **regulations** does the company use (e.g., in-house expertise, consultants, provincial government, etc.)?
MOE, CONSULTANTS, IN HOUSE

2. What sources does the company turn to for information on **technologies** for the reduction of wastes and emissions (e.g., in-house expertise, consultants, provincial government, etc.)?
CONSULTANTS, SUPPLIERS, MOE, IN HOUSE

3. How many engineers are on staff at the plant site? ~10

   Of these, how many have the time and mandate to work on controlling wastes at the plant (other than the ON-SITE worker)?
   1

4. a. How many other staff with some technical training have the time and mandate to work on controlling wastes? Ø

   b. Briefly describe their qualifications and roles in the company.

c. Does the company make use of waste management consultants?

✓ Yes ___ No

If yes, how often (full-time, part-time, once-only) PART-TIME/NEED BASIS

If not, why not? _____

5. What potential does the company think the various waste management approaches have for this plant?[1]

Reduction	___ Good potential	✓ Some potential	___ No potential
Reuse	✓ Good potential	___ Some potential	___ No potential
Recycling	✓ Good potential	___ Some potential	___ No potential
Recovery	✓ Good potential	___ Some potential	___ No potential
Treatment	✓ Good potential	___ Some potential	___ No potential
Disposal	___ Good potential	✓ Some potential	___ No potential

6. Does the company give the "4Rs" priority when looking at waste management solutions?

✓ Yes ___ No

7. Would the company be willing to pay more for a "4Rs" solution than for treatment and/or disposal?

✓ Yes ___ No

---

[1] Terms are defined as follows.
Reduction: not producing the waste in the first place, e.g., through process control or redesign, chemical substitution
Reuse: using a waste material, e.g., plastic regrind, again in its original form
Recycling: separating a waste material at source and reusing it, in the same process or in a different process
Recovery: removing materials from the mixed waste stream for sale or use off-site
Treatment: treatment on-site before discharge or disposal

4Rs CASE STUDY: K3

POLYMER CONCENTRATE BLENDER

COMPANY CONCERNS

This company produces polymer concentrates to be used by its customers in the production of plastics. The ON-SITE worker placed in this company addressed several waste management concerns, including:

- the disposal of used paper and polyethylene bags
- waste polyethylene flush collection and reuse/resale
- disposal of wooden pallets
- reduction of solvent use, and
- refurbishing the railyard and loading dock to reduce spills and improve recovery of spilled materials.

4Rs ACTIVITIES

Paper/Polyethylene Bags

The many additives used in blend preparation are supplied in paper, polyethylene and paper/polyethylene bags. During a normal 24-hour production run, the company accumulates approximately 1,000 such bags as waste. Currently, collection depots are set up at each of the five blending stations. Empty bags are placed in a hanging container bag which is transported to a garbage trailer outside the building. The dust which accumulates from the bags is a concern.

The company wanted to investigate a system which would deliver and compact the bags automatically, reduce dust and ensure the prompt transit of the bags from operations to compaction where the material could be presented for either disposal or end-user purposes. A baler and a duct system/baler combination were proposed, but neither were judged cost-efficient. One baler without a duct or dust suppression system would have a payback of about 7.7 years.

The company is attempting to find another company that would be interested in taking the bags for reuse or recycling, but has not yet been successful. They continue to be interested in investigating 4Rs solutions for dealing with the pigment and additive dusts.

Waste Polyethylene Flush Disposal

On average, this company conducts 54 product changes monthly. With each change, the system must be flushed to remove the previous product, and to ensure that the colour of the new product line is of satisfactory quality.

Estimates for 1988-89 show that production of 3,300 tonnes of concentrate will result in the generation of about 60 tonnes of waste polyethylene (5 tonnes per

month). This flush material includes waste polyethylene of different colours and formulations. At present, small amounts of these wastes are retained until either the colour can be upgraded to acceptable levels, or controlled amounts can be added to normal production runs.

With polyethylene costs running at $1.705/kg, the company could potentially save $102,000/year if the all of flush polyethylene could be re-used inhouse. The company investigated building a flush collection system that would transport flush to a spare composite blender. The blender would serve as a holding tank and, when full, would produce a uniform batch of off-spec colour resin which could be used in the production of products such as garbage bags.

Originally, the company thought that such a system could enable recovery of all five tonnes of polyethylene per month, resulting in monthly savings of $8,525. At this rate, the company could pay back the costs of installing a $23,000 collection system in 2.7 months. However, the company discovered that, at present, only about 50% of the flush polyethylene could be run through such a system. To handle more, an additional composite blender will be required, necessitating substantial capital investment. As well, a small portion of the waste is too poor in quality to be reused.

However, given that the payback at even 50% reuse is less than 6 months, the company plans to purchase and install this system in the near future. To deal with the other 50% of the waste, the company has found a plastics recycling firm that will accept the waste. An initial load of 14,364 kg was tested by the recycling firm, and a price of 40 cents/kg was arrived at. Given that the price for virgin material is considerably higher, the company ultimately hopes to reuse as much as possible of the flush waste on-site.

Wooden Pallets

Wooden pallets are used to ship raw materials to the plant. The company also uses them to move materials around within the plant, and in this process many pallets were being overloaded and broken. Since recyclers were not interested in broken pallets, they had to be landfilled.

The company has now evolved a unique system for maintaining and tracking wooden pallets. Pallets are now coloured-coded by weight, so that lightweight pallets are not used (and broken) by heavy loads. If pallets do break, plant employees are encouraged to take them home for firewood. Through posted notices and through the local newspaper, the company has encouraged area residents to pick up pallets, and employees, their acquaintances and local farmers have done so. The company no longer sends any pallets to landfill.

Reduction of Solvent Use

During normal operations, a residual layer of the blend adheres to all contact surfaces of both the blenders and the mixing tubs. Currently, company employees use varsol-soaked rags to clean surfaces between production batches. This is a long, labour-intensive process, and the company wanted to eliminate the use of solvents in this cleaning process.

The ON-SITE employee was charged with finding a suitable, non-transferable and inert release agent coating, capable of being washed with high-pressure hot water, which would ensure the complete separation of all residual powder from equipment surfaces. The release agent also had to be more economical than the current cleaning system.

Two slip-release agents were tested, but results showed that stainless steel test plates required no such agents; the plates themselves provided adequate release conditions when high-pressure hot water was used. The company is now investigating the costs of covering one sample tub with stainless steel and repeating the washing operation. If the test tub performs as expected, all tubs will be similarly covered, providing a low-maintenance, solvent-free cleaning system.

Instituting such a wash system will result in a major increase in the amount of wastewater leaving the company. Solid materials such as lead, chromium, cadmium and silica, which would not meet expected MISA effluent standards, could end up in the local sewer system if not removed from the wastewater. To deal with this issue, the company is considering pH adjustment to precipitate the heavy metals, and installation of a filtration system which would remove the remaining solids. Such a system would include a wash water storage tank to control the flow into the filtration system in order to optimize its removal efficiency.

Once an appropriate system has been installed, the company expects to be able to exceed expected MISA sewer use standards. The filtrate will be disposed of by a registered off-site receiver.

Railyard and Loading Dock Refurbishing

Spills occur when polyethylene and resin material are being moved from trains to trucks, and from trucks to a storage silo. Finding a means of reducing or eliminating spillage was a company priority, but the loading area needed to be cleaned up first.

A local contractor was hired to remove soil and cinders at the railroad siding, which had been contaminated with spilled resins and polyethylene over the years. When the cleanup was complete, the company decided to take steps to eliminate accidental material spillage.

- A catch basin was built under the attachment leading from the railcar to the silo. This 24" by 24" by 6" stainless steel tray prevented the polyethylene and resin pellets from falling to the ground and contaminating the surrounding area.

- Formerly, the discharge nozzles of railcar cleaning equipment blew out onto the ground. Retention bags will soon cover the nozzles during cleaning, and the material which is collected will be re-inserted into the production process.

- The loading areas within the railroad siding will soon be paved to make it easier to clean-up spills. Once the area is paved, the company will be able to collect spilled pellets. If contamination is minimal, these pellets may be reusable.

The company estimates that these improvements will cost about $5,000. Savings in raw materials and lower spill clean-up costs are expected, but cannot be quantified at this time.

WASTE MANAGEMENT RESEARCH QUESTIONNAIRE

PART ONE: GENERAL INFORMATION

Name: (K3)
Title: PLANT ENGINEER
Company:
Address:
# of Employees: 80
Principal Products/Services: POLYMER CONCENTRATES

Type of Waste & Quantities: EMPTY 25 kg. BAGS, PIGMENT / ADDITIVE WASTE TO DUST COLLECTION (100 kg/WEEK), POLYMER FLUSH (RESIN MATERIAL), PALLETS
Type of Disposal: LANDFILL, TRICIL

1. What sources of information on environmental and waste management **regulations** does the company use (e.g., in-house expertise, consultants, provincial government, etc.)?
MOE for P.C.B.'S, EXHAUST DISCHARGE
CITY ENGINEERING - CONTAMINENT CONCENTRATIONS IN EFFLUENT, LANDFILL REGULATIONS
WASTE COMPANIES - TRICIL, CITY INDUSTRIAL SOLID/LIQUID WASTE SEMINARS

2. What sources does the company turn to for information on **technologies** for the reduction of wastes and emissions (e.g., in-house expertise, consultants, provincial government, etc.)?
IN HOUSE

3. How many engineers are on staff at the plant site? 1

   Of these, how many have the time and mandate to work on controlling wastes at the plant (other than the ON-SITE worker)? 1

4. a. How many other staff with some technical training have the time and mandate to work on controlling wastes? 3

   b. Briefly describe their qualifications and roles in the company.
PLANT MANAGER - OVERSEES ALL PROJECTS & PROCESSES
PRODUCTION SUPERVISOR - ORGANIZES PRODUCTION, STREAMLINES PRODUCTION
MAINTENANCE FOREMAN - RUNS MAINTENANCE DEPT.

c. Does the company make use of waste management consultants?

✓ Yes ___ No

If yes, how often (full-time, part-time, once-only) WHEN NEED ARISES FOR WASTE WATER TREATMENT

If not, why not? _____

5. What potential does the company think the various waste management approaches have for this plant?[1]

Reduction	✓ Good potential	___ Some potential	___ No potential
Reuse	✓ Good potential	___ Some potential	___ No potential
Recycling	___ Good potential	✓ Some potential	___ No potential
Recovery	✓ Good potential	___ Some potential	___ No potential
Treatment	✓ Good potential	___ Some potential	___ No potential
Disposal	✓ Good potential	___ Some potential	___ No potential

6. Does the company give the "4Rs" priority when looking at waste management solutions?

✓ Yes ___ No

7. Would the company be willing to pay more for a "4Rs" solution than for treatment and/or disposal?

✓ Yes ___ No

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[1] Terms are defined as follows.
Reduction: not producing the waste in the first place, e.g., through process control or redesign, chemical substitution
Reuse: using a waste material, e.g., plastic regrind, again in its original form
Recycling: separating a waste material at source and reusing it, in the same process or in a different process
Recovery: removing materials from the mixed waste stream for sale or use off-site
Treatment: treatment on-site before discharge or disposal

4Rs CASE STUDY: L2

ADHESIVES MANUFACTURER

COMPANY CONCERNS

This company produces industrial and consumer adhesives in a batch production process. With the assistance of an ON-SITE worker, the company has made progress in the areas of best management practice, packaging recycling, and solvent recovery.

4Rs ACTIVITIES

Best Management Practice

The project worker was assigned the task of studying all plant waste streams and determining the maximum reduction achievable. One of the first waste streams studied resulted from the subjective quality control being carried out by line workers who were not trained as quality control personnel. Workers were scrapping good product and packaging for such things as minor labeling flaws and underfilling.

The ON-SITE worker helped to improve worker awareness that these "wastes" could be reused rather than discarded. This has greatly reduced the amount of waste produced. All non-contaminated off-spec product (predominantly underfilled packages) is now reinserted into the production line when the next batch of that product is run. The company is also investigating the marketability of off-spec solvent-based products (e.g., epoxies), which cannot be reused, to the Ontario Waste Exchange (OWE).

Now that off-spec product wastes have been reduced, mixing vessels are the main source of plant waste. If a solvent with the same base as the product being mixed is used to clean a vessel, excess product that has built up on the vessel can be thinned and the resultant liquid can be re-inserted into the production process. However, if an inappropriate solvent is used and contaminates the substance in the vessel, the resultant liquid must be disposed of as a waste product.

The solution to this problem is to take measures to educate plant employees about the use of appropriate cleaning solutions. Future efforts will focus on ensuring that employees have equal, easy access to all solvents. The company would like to reduce mixing vessel wastes to zero.

Packaging Recycling Activities

Packaging wastes produced by this company include cardboard, kraft bags, plastic film waste, and plastic containers. Most of the cardboard and kraft bags arrive at the plant as packaging for raw materials. Plastic film is used for skid wrap on incoming and outgoing materials. Plastic containers include raw material buckets and drums and off-spec product tubes.

Before the ON-SITE worker arrived at the company, all cardboard went to landfill (tipping fees -- $50 per tonne). All cardboard is now collected from 11 generation points (e.g., shipping, packaging lines) using wooden wheeled containers. Currently, four to six tonnes of cardboard are recovered per week, saving the company $13,000 a year in disposal costs, and generating revenue of $6,500 per year.

Domtar Recycling Inc. has loaned the company a baler, and in return pays less than market value for the collected material. If company management decides that the cardboard recovery pilot program has been successful enough, the company will purchase its own baler and increase the revenue from sales.

Domtar also collects kraft bags. The host company must ensure that plastic liners have been removed before Domtar collects them, and this has not posed any problems.

Plastic film is collected free of charge by a plastics broker which the company contacted through the OWE.

Another buyer was engaged to collect used plastic containers. The first company engaged to collect these plastics complained of high contamination rates. A second company expressed interest in purchasing these materials, and they were hired in December 1988. Unlike the first company, the second recycling firm will pay the host company a return for the plastics if they can be kept clean enough. Based on the specifications provided by the recycling company, company representatives are confident that their used plastics will be clean enough to generate revenue. The new broker has been very satisfied with the first two months' shipments.

However, plastics contamination, which is a function of product handling and the wide variety of materials collected, is an ongoing concern. If no regular payment is received for the plastics, the cost of material collection will end this recycling initiative.

In early 1989, this company plans to establish an office paper recycling program.

Solvent Recovery Initiatives

At this time, wash solvents (toluene, hexane, MEK) are recycled off-site at Chem-King in Barrie. Some 40 drums are generated every three months; the cost of recycling is $36 per drum. This low cost of sending the solvents for off-site recycling has meant that investigations of on-site solvent recovery have taken a low priority.

Preliminary research estimated the cost of a distillation unit to be between $30,000 and $40,000. An additional impediment to on-site recovery is the fact the the still bottoms would require expensive disposal, since they cannot be landfilled. Since the company has learned of a Michigan recycling firm which

will charge even less than Chem-King there is little incentive at present to pursue on-site recycling.

However, future plans call for volume quantification to determine the plant's distillation needs, as well as a determination of the disposal costs of the still bottoms. By finding out how large a still is needed, the company can determine how efficiently they can recycle solvents. This will allow them to maximize their in-house recycling capabilities and minimize their outside material purchases.

WASTE MANAGEMENT RESEARCH QUESTIONNAIRE

PART ONE: GENERAL INFORMATION

Name: (L2)
Title: Waste Management Co-ordinator
Company:
Address:
# of Employees:
Principal Products/Services: adhesives

Type of Waste & Quantities: solvents, resins, latex, glue

Type of Disposal: landfill, incineration, in-house

1. What sources of information on environmental and waste management **regulations** does the company use (e.g., in-house expertise, consultants, provincial government, etc.)?
   PROVINCIAL GOVERNMENT, SEMINARS, PUBLICATIONS

2. What sources does the company turn to for information on **technologies** for the reduction of wastes and emissions (e.g., in-house expertise, consultants, provincial government, etc.)?
   PUBLICATIONS, IN-HOUSE EXPERTISE

3. How many engineers are on staff at the plant site? 6

   Of these, how many have the time and mandate to work on controlling wastes at the plant (other than the ON-SITE worker)? 3

4. a. How many other staff with some technical training have the time and mandate to work on controlling wastes? 4

   b. Briefly describe their qualifications and roles in the company.
   THEY ARE SUPERVISORS WITH SOME TECHNICAL COURSES

c. Does the company make use of waste management consultants?

___ Yes _X_ No

If yes, how often (full-time, part-time, once-only) _____

If not, why not? IT'S NOT NEEDED; THE STAFF CAN HANDLE THE PROBLEMS.

5. What potential does the company think the various waste management approaches have for this plant?[1]

Reduction	✓ Good potential	__ Some potential	__ No potential
Reuse	✓ Good potential	__ Some potential	__ No potential
Recycling	✓ Good potential	__ Some potential	__ No potential
Recovery	✓ Good potential	__ Some potential	__ No potential
Treatment	__ Good potential	__ Some potential	✓ No potential
Disposal	__ Good potential	__ Some potential	__ No potential

6. Does the company give the "4Rs" priority when looking at waste management solutions?

✓ Yes __ No

7. Would the company be willing to pay more for a "4Rs" solution than for treatment and/or disposal?

✓ Yes __ No

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[1] Terms are defined as follows.
Reduction: not producing the waste in the first place, e.g., through process control or redesign, chemical substitution
Reuse: using a waste material, e.g., plastic regrind, again in its original form
Recycling: separating a waste material at source and reusing it, in the same process or in a different process
Recovery: removing materials from the mixed waste stream for sale or use off-site
Treatment: treatment on-site before discharge or disposal

4Rs CASE STUDY: P2

RESIN MANUFACTURER

COMPANY CONCERNS

This company produces resins that are used both on-site and by customers in the production of plastics. The facility employs 73 workers, including two engineers. One of these engineers works full-time on environmental control.

The company places a high priority on 4Rs options when looking at waste management and production concerns. They have expressed this commitment by implementing 4Rs waste management alternatives, even when there was no immediate or expected payback on investment. Participating in the ON-SITE program was only one small part of this company's waste management efforts.

4Rs ACTIVITIES

Zinc Stearate

During one phase in the production of polystyrene resins, dust is generated. The main constituent of this dust is zinc stearate. After accumulating in a dust collector, this waste was, at one time, bagged, boxed and landfilled once a year. Although the cost of landfilling was minimal, the company felt that there could be a more productive end use for this waste.

Three options were considered. The first was to keep the status quo of landfilling the waste. Another was to use the waste as an inexpensive dusting agent. The final solution was to use the Ontario Waste Exchange to find a receiver who could use the material as a raw material.

The company chose the third option, and a colour compounding company was located through the Exchange. This company agreed to receive the approximately 600 kilograms a year and pay for the cost of transportation. The company estimated that it cost approximately $500 in employee time to set up and process the exchange of the zinc stearate, which it considers a small cost to pay for finding a productive use for the waste.

Ethyl Benzene and Styrene Monomer

In the later stages in the production of styrene resins, vapours containing ethyl benzene and styrene monomer are generated during a vacuum/heat process. These vapours are condensed and collected at an estimated rate of 200,000 gallons a year.

The company considered two options for dealing with these vapours. The first was to incinerate them for internal use. The alternative was to re-introduce the waste into the feed stream, mixed with virgin material.

The company chose to reintroduce the wastes back into the process for reuse as a raw material, and has been pilot-testing the concept. Once the system is fully implemented, the company expects to save more than $117,000 per year on raw materials alone. The pilot results also indicate that, in addition to the raw material savings, materials handling and incineration costs are greatly reduced. Although there were the usual start up problems and much more work remains to be done, the benefits are obvious to the company and they intend to pursue full-scale implementation.

Reduction of Sampling

Polymerizing reactors within the plant have a number of sampling valves through which partially polymerized product is collected for testing against quality standards. With the ongoing quality assurance sampling program that is necessary in any manufacturing environment, there is a continuing generation of waste material. This accumulation, which has reached 2,400 gallons per year, is a major disposal concern for the facility.

The company's practice has been to allow the waste to polymerize by retaining it on-site until it solidifies and can be landfilled as an inert waste. However, the company has been considering a number of other options for dealing with this waste. For instance, it has considered allowing the waste to polymerize in 45 gallon drums that are sealed to allow the draw-off and condensation of the vapours for further use as feedstock. The remaining solids would be landfilled. It has also looked into off-site incineration, but has not been able to locate a suitable incinerator. The possibility of sending the waste to a transfer station, to be blended with solvents and sent for incineration in the United States, is also being investigated.

However, the company recognizes that the best approach is to improve overall process control to reduce the need for the multiple and frequent sampling program now in place. A major push is underway to increase the efficiency and stabilization of process running conditions. This should have a significant impact on the generation of this particular waste by reducing the number of times a batch of product has to be sampled.

Scrap Plastic

The generation of start-up and equipment failure material scrap is expected in the manufacturing of most products that require a viscous material to be passed through an injection system. This process facility is no different. A total of 7,000 kg of 11-45 kg plastic lumps are formed every month as a result of equipment shutdown, product change and machinery failure.

After considering several options, the company opted to sell the scrap plastic to a local plastics recycler. It was found to be much too costly to consider the off- or on-site grinding of the material for further use within the process. In selling to the recycler, the company can avoid additional equipment, operating and maintenance costs while being assured that the waste is being handled in a cost-effective and environmentally appropriate manner.

Styrene Scrap

Ten years ago, the company attempted to reintroduce styrene scrap back into the feed stream. The styrene scrap was collected and stored on-site until it was needed as feedstock. It was then fed into the normal process as feed material to complement virgin styrene stock. After much experimentation, the project was found to be a "disasterous failure". Considerable problems were experienced with clogging of machinery, and the quality of the finished product was extremely poor. After a number of attempts, the project was shelved. The 3,000 -3,500 gallons of styrene scrap that are collected every year are now sent to a registered incinerator for disposal.

Recycled Oils

As with any manufacturing environment, the use of oil products in the operation and maintenance of machinery is extensive and diverse. At this facility, oily wastes are generated in engine crankcases, gear boxes, hydraulic power packs and heat transfer units. Having decided that it wanted to recycle as much oil as possible, the company's primary concern was how to best collect the various qualities and quantities of oil throughout the plant while keeping contamination at a minimum.

Investigation showed that the method(s) chosen for the management of waste oils in the plant depended on:

a) Qualities of the oil waste, i.e., hydraulic fluids, heat transfer fluids, etc.
b) The manner in which the oils would be collected, i.e., from bleeding machines, leaks from systems, etc.
c) The level of contamination present.

The above factors would dictate how the oils were handled and treated both on- and off-site. If the oils were being bled directly from a machine or system, then little extraneous contamination would usually be present. If there was a leak in a system, and the oil had to be retrieved with absorbents, then there would be extreme contamination. Because of the importance of generating resalable oils to re-refiners with as few contaminants as possible, the company was forced to improve the internal handling of this waste.

Spilled and Leaked Oils

When oils were accidentally spilled during transport or leaked from machinery, the company had been using clay absorbents during clean-up. This 'new' waste was then sent to landfill for burial. When the company worked out the economics, it found that it would be cost-effective to manually squeeze the pads to recover the oil for recycling; the pads could then be reused. On an annual basis, the sale of two 45-gallon drums of oil recovered from absorbent pads, plus the savings generated by reducing the amount of waste going to landfill, more than offset the labour required for the procedure.

Hydraulic Oils

The segregation of waste oils at source is also of concern to the company. By controlling the collection of the various oils and fluids throughout the plant, the company has found that it receives a better price for its oil from re-refiners.

The company has now started to filter and reuse the hydraulic oils it uses in the plant. After it is collected and kept separate from other oils to prevent contamination, the oil is filtered and reused at the facility. Last year 225 gallons of hydraulic oil were reclaimed and reused.

Summary

The savings expected from the improved methods and procedural changes used to deal with waste oils are conservatively estimated at $2,500 per year.

Cardboard Waste

During normal operations at this facility, cardboard waste is generated at a rate of approximately 20 tonnes a year. This volume encouraged the company to purchase, install and operate an on-site compactor. Employees were trained to direct all cardboard waste to the compactor and to be conscious of avoiding contamination. The company is now attempting to solicit a local company to haul their smaller loads more frequently in order to free up warehouse space.

Revenue generation was not a significant contributing factor in the decision to purchase in-house compacting capabilities. Although one of the company's suppliers switched from wax-treated boxes to plain cardboard, which eliminated one source of contamination, revenues from the sale of the waste are only $400 per year. Similarly, local tipping fees are negligible, so cost avoidance was not the motivating factor. Rather, the company saw cardboard waste as an opportunity to practise a 4Rs philosophy.

Future Plans

The company will continue to look for more ways to incorporate reuse and recycling options in the daily operations of the plant and the handling of their waste. Although some of the 4Rs projects they attempted have not been successful, several have, and will continue to be, profitable.

WASTE MANAGEMENT RESEARCH QUESTIONNAIRE

PART ONE: GENERAL INFORMATION

Name: (P2)
Title: PROCESS ENGINEER
Company:
Address:
# of Employees: 73
Principal Products/Services: RESINS

Type of Waste & Quantities:

Type of Disposal: VARIOUS

1. What sources of information on environmental and waste management **regulations** does the company use (e.g., in-house expertise, consultants, provincial government, etc.)?
   CONSULTANTS, IN-HOUSE, PROVINCIAL GOV.

2. What sources does the company turn to for information on **technologies** for the reduction of wastes and emissions (e.g., in-house expertise, consultants, provincial government, etc.)?
   IN-HOUSE, CONSULTANTS

3. How many engineers are on staff at the plant site? 2 (1 MORE ON

   Of these, how many have the time and mandate to work on controlling wastes at the plant (other than the ON-SITE worker)? 1

4. a. How many other staff with some technical training have the time and mandate to work on controlling wastes? 1

   b. Briefly describe their qualifications and roles in the company.
   PROJECT ENGINEER WILL HANDLE AS A MAJOR TASK THE DIRECTION OF FUNDS WHICH HAVE BEEN SET-UP FOR ENVIRONMENTAL UPGRADE. HEALTH AND SAFETY CO-ORDINATOR PRESENTLY RESPONSIBLE FOR WASTE MANAGEMENT.

c. Does the company make use of waste management consultants?

✓ Yes ___ No

If yes, how often (full-time, part-time, once-only) EXTENSIVE WORK HAS BEEN DONE

If not, why not? _____

5. What potential does the company think the various waste management approaches have for this plant?[1]

Reduction	___ Good potential	___ Some potential	___ No potential
Reuse	___ Good potential	✓ Some potential	___ No potential
Recycling	___ Good potential	✓ Some potential	___ No potential
Recovery	___ Good potential	___ Some potential	___ No potential
Treatment	___ Good potential	✓ Some potential	___ No potential
Disposal	___ Good potential	✓ Some potential	___ No potential

6. Does the company give the "4Rs" priority when looking at waste management solutions?

✓ Yes ___ No

7. Would the company be willing to pay more for a "4Rs" solution than for treatment and/or disposal?

✓ Yes ___ No

ORDER)

[1] Terms are defined as follows.
Reduction: not producing the waste in the first place, e.g., through process control or redesign, chemical substitution
Reuse: using a waste material, e.g., plastic regrind, again in its original form
Recycling: separating a waste material at source and reusing it, in the same process or in a different process
Recovery: removing materials from the mixed waste stream for sale or use off-site
Treatment: treatment on-site before discharge or disposal

4Rs CASE STUDY: V1

PAINT MANUFACTURER

COMPANY CONCERNS

This company manufactures paints, stains and powder coatings for the retail and industrial markets. The company had been spending $98,000 per year on liquid waste disposal, predominantly on solvent wastes, including still bottoms from an in-house solvent recovery still. It had been experiencing a number of problems with this still.

The company took on an ON-SITE worker to review the capabilities and efficiencies of its solvent still and to investigate alternatives to in-house solvent distillation. The ON-SITE worker also carried out preliminary research into 4Rs strategies for dealing with paint wastes and solid wastes.

4Rs ACTIVITIES

Solvents

The company uses 40,000 gallons per year of toluene and 75,000 gallons per year of MIBK as cleaning solvents during production. Ten years ago, the company purchased a distillation unit from Interdyne to recover solvents. Over time, recovery rates had dropped to between 58 and 62%; the reasons for this poor performance were unclear. Overall, the still was costing $144,800 per year to operate (this figure includes steam, cooling water, electricity, disposal of wastes and solvent replacement costs).

The ON-SITE worker analysed the still operation and found that its poor performance was due to inefficient steam distribution, caused in part by a buildup of deposits in the steam lines. For several reasons, he recommended that the company contemplate the purchase of a new still. Among these considerations were the fact that Interdyne's direct steam injection process introduces water into the waste stream, thus adding to the volume to be disposed of. As well, the manufacturer had gone out of business, so servicing had become a problem. The unit is now ten years old, and nearing the end of its service life.

The company realized that the time had come to replace the still, and requested that the ON-SITE worker investigate alternatives to in-house distillation. The project worker found that if the company went to a system of purchasing only virgin solvent and disposing of it without recourse to reclamation they would be spending $342,000 each year. If the company were to make use of solvent reclaimers they would spend either $141,000 (based on an 80% recovery rate at Anachemia) or $153,600 (at a 70% rate at Varnicolor) per year.

In addition, the ON-SITE worker costed six new still systems; these ranged in price from $76,000 to $221,000. Paybacks were calculated from nine months to two years, and annual savings were estimated to be between $66,000 and $100,000.

As a result of the information supplied by the ON-SITE worker, the company set aside $110,000 for the purchase of a new still, but purchase plans have been stalled by the parent company because of fiscal restraints. At this time, all expenditures are on hold, except those which are aimed at maintaining production. The $110,000 earmarked for the new still purchase in 1988 has been allocated for other uses.

Mixing Vessels

The company has no formal paint vessel cleaning methods in place; an employee simply chisels off paint buildup when it gets too thick. Preliminary research into alternate cleaning strategies has been performed, but again, they are not being considered in light of the company's current financial situation. Systems investigated ranged in price from $25,000 to $100,000.

Solid Waste

The company spent $16,500 on solid waste disposal in 1988. Solid wastes are predominantly packaging materials received with raw materials (OCC, pallets, plastics, etc.). There are currently no solid waste 4Rs initiatives being contemplated, though the receiving foreman responsible for disposal is aware of impending landfill bans on OCC, wood and other materials. The company has begun to segregate OCC, but has yet to make any arrangements for recycling.

Future Plans

The company is very interested in increasing the quality of treated solvents for eventual re-use in the production of paint. As outlined above, several waste reduction plans have been made, but these will remain on hold until the parent company resolves its own financial situation.

WASTE MANAGEMENT RESEARCH QUESTIONNAIRE

PART ONE: GENERAL INFORMATION

Name: (V1)
Title: LOSS CONTROL ENGINEER
Company:
Address:
# of Employees: 135
Principal Products/Services: PAINTS AND COATINGS

Type of Waste & Quantities: SCRAP POWDER PACKAGING
LIQUID PAINT WASTE
Type of Disposal: LANDFILL ; INCINERATION

1. What sources of information on environmental and waste management **regulations** does the company use (e.g., in-house expertise, consultants, provincial government, etc.)?
IN-HOUSE, GOVERNMENT

2. What sources does the company turn to for information on **technologies** for the reduction of wastes and emissions (e.g., in-house expertise, consultants, provincial government, etc.)?
GOVERNMENT

3. How many engineers are on staff at the plant site? 1

Of these, how many have the time and mandate to work on controlling wastes at the plant (other than the ON-SITE worker)? 0

4. a. How many other staff with some technical training have the time and mandate to work on controlling wastes? 1

b. Briefly describe their qualifications and roles in the company.
RECEIVING FOREMAN - AS PART OF HIS DUTIES HE HANDLES DISPOSAL OF WASTES AND HAS CONTACTS BOTH IN GOVERNMENT AND DISPOSAL COMPANIES.

c. Does the company make use of waste management consultants?

___ Yes ✓ No

If yes, how often (full-time, part-time, once-only) _____

If not, why not? THE NEED HAS NEVER ARISEN

5. What potential does the company think the various waste management approaches have for this plant?[1]

Reduction	___	Good potential	✓	Some potential	___ No potential
Reuse	___	Good potential	✓	Some potential	___ No potential
Recycling	___	Good potential	✓	Some potential	___ No potential
Recovery	___	Good potential	✓	Some potential	___ No potential
Treatment	___	Good potential	___	Some potential	✓ No potential
Disposal	✓	Good potential	___	Some potential	___ No potential

6. Does the company give the "4Rs" priority when looking at waste management solutions?

✓ Yes ___ No

7. Would the company be willing to pay more for a "4Rs" solution than for treatment and/or disposal?

✓ Yes ___ No

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[1] Terms are defined as follows.
Reduction: not producing the waste in the first place, e.g., through process control or redesign, chemical substitution
Reuse: using a waste material, e.g., plastic regrind, again in its original form
Recycling: separating a waste material at source and reusing it, in the same process or in a different process
Recovery: removing materials from the mixed waste stream for sale or use off-site
Treatment: treatment on-site before discharge or disposal

TRANSPORTATION

4Rs CASE STUDY: A3

AUTO PARTS MANUFACTURER

COMPANY CONCERNS

This auto parts manufacturer has a number of divisions which operate essentially autonomously, and respond to the suggestions made by the company environmental affairs (E.A.) advisor at their own pace. This case study focuses on three 4Rs activities undertaken by different divisions: old corrugated cardboard (OCC) recycling, the reduction of oily wastes from a metal stamping line, and the reduction of waste from a heat treatment facility.

4Rs ACTIVITIES

OCC Recycling

During the summer of 1988, the E.A. advisor sent a survey to a number of divisions asking them to quantify the amount of OCC they generated, and to gauge their interest in participating in a pilot OCC recycling program. The motivation for beginning such a program was an upcoming ban on landfilling OCC. The divisional response was generally good.

The E.A. advisor then approached the company's waste carrier about participating in a pilot OCC collection program. The carrier was very positive, and a three month pilot project was initiated in early 1989.

After the first three weeks of the recycling pilot program, a total of nine divisions were contributing 10 tons of OCC per week. Due to market conditions, the price paid for OCC has dropped from $70/ton to $30/ton. The company sells its OCC to the highest bidder, either Domtar Recycling Inc. or Atlantic Packaging Inc.

By recycling the OCC, the company is generating revenues of $300 to $700 per week and saving more than $500 per week in avoided tipping fees. At the time of writing, the company was gathering information about the most efficient way to collect material, the time required to load OCC, and employee attitudes to the program. Ultimately, this information will be used to determine if the company needs additional recycling equipment such as balers and storage facilities.

Before the ban was implemented, the company was paying $100/ton to dispose of OCC. Now that it recycles the OCC, its net cost for handling OCC is $40/ton.

The company has other divisions also operating in the landfill's service area; all those generating significant quantities of OCC will eventually participate in the OCC recycling program. The program is being considered a success so far, and its proponents feel that its expansion will be viewed favourably by company management.

Oily Waste Reduction

One division's metal stamping deburring process generates 5,000 gallons of oily water wastes per month. The deburring takes place in a tumbling tank which uses ceramic chips of different sizes and shapes. Another division had a similar oily water problem, and solved it by purchasing a Purospan Industries Inc. ultrafiltration (UF) system to treat the waste water. The second plant is following the example of the first, and is now in the process of installing a UF system. The purchase of this system was made easier by the precedent set by the sister company.

The system consists of:

- a gross skimming tank
- a collection tank, with an angled bottom for sludge removal
- a work tank (also called a secondary holding tank)
- a paper band filter (to remove larger suspended particles)
- membrane filtration (which allows waste water to recirculate until it is sufficiently clean)
- a permeate tank, and
- a collection tank (which doses the tumbling tank with recycled water and chemicals as required).

All or part of the system can be back-washed at any time.

On average, the oily waste is 90% water; small quantities of detergents and corrosion inhibitors are also present. Capital costs of the UF system were $43,500; operating costs are $10,900 per year. Disposal costs were $60,000 per year, so payback was calculated at less than one year. An additional $6,000 per year will be saved in reduced chemical costs because chemicals are recycled by the system.

The system will be operational in the spring of 1989. The water will be recycled; the waste products which remain are contaminated oil (8%), sludge and filings (2%). These substances will have to be landfilled. The division is now looking for ways to recycle the oil component.

Reduction of Waste From a Heat Treatment Facility

Heat treatment hardens metals, making them more resistant to stress. In this plant, the heat treatment facility treats parts such as springs. Problems occur when parts are run through a soaking/cleaning tank to remove surface dirt and oils prior to entering the treating ovens. As parts leave the soak tanks, a film of oily contamination from the surface of the soak tank re-adheres to the parts; this residue gets baked onto the parts by heat treatment and results in quality control problems. Company efforts to keep the surface of the tank oil-free were insufficient.

The E.A. advisor has proposed the purchase of a $74,000 UF system from Purospan which will continuously remove contaminating oils from the soak tank. The proposal specified that the system include two soak tanks to accommodate

any increase in production, and it will be able to incorporate mechanical skimming if the company determines that skimming is required after installation. Beyond the quality control benefits, the system will reduce chemical costs (tank chemicals will last longer) and tank solution disposal costs (cleaner solution will not have to be regenerated as often).

WASTE MANAGEMENT RESEARCH QUESTIONNAIRE

PART ONE: GENERAL INFORMATION

Name: (A3)
Title: ENVIRONMENTAL and SAFETY COORDINATOR
Company:
Address:
# of Employees: 4000
Principal Products/Services: AUTOMOTIVE COMPONENTS

Type of Waste & Quantities: VARIOUS

Type of Disposal: VARIOUS

1. What sources of information on environmental and waste management **regulations** does the company use (e.g., in-house expertise, consultants, provincial government, etc.)?
   IN-HOUSE, CONSULTANTS, MOE, O.W.M.C., JOURNALS, OTHER PUBLICATIONS.

2. What sources does the company turn to for information on **technologies** for the reduction of wastes and emissions (e.g., in-house expertise, consultants, provincial government, etc.)?
   AS ABOVE IN 1.

3. How many engineers are on staff at the plant site? WRITER NOT AN ENGINEER

   Of these, how many have the time and mandate to work on controlling wastes at the plant (other than the ON-SITE worker)?
   NO ENGINEERING STAFF HAS DIRECT MANDATE FOR WASTE MANAGEMENT

4. a. How many other staff with some technical training have the time and mandate to work on controlling wastes? NONE

   b. Briefly describe their qualifications and roles in the company.

c. Does the company make use of waste management consultants?

✓ Yes ___ No

If yes, how often (full-time, part-time, once-only) PART-TIME, ON PROJECT BASIS

If not, why not? _____

5. What potential does the company think the various waste management approaches have for this plant?[1]

Reduction	✓ Good potential	___ Some potential	___ No potential
Reuse	___ Good potential	✓ Some potential	___ No potential
Recycling	✓ Good potential	___ Some potential	___ No potential
Recovery	___ Good potential	___ Some potential	___ No potential
Treatment	✓ Good potential	___ Some potential	___ No potential
Disposal	___ Good potential	___ Some potential	___ No potential

6. Does the company give the "4Rs" priority when looking at waste management solutions?

✓ Yes ___ No

7. Would the company be willing to pay more for a "4Rs" solution than for treatment and/or disposal?

✓ Yes ___ No

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[1] Terms are defined as follows.
Reduction: not producing the waste in the first place, e.g., through process control or redesign, chemical substitution
Reuse: using a waste material, e.g., plastic regrind, again in its original form
Recycling: separating a waste material at source and reusing it, in the same process or in a different process
Recovery: removing materials from the mixed waste stream for sale or use off-site
Treatment: treatment on-site before discharge or disposal

4Rs CASE STUDY: C8

AUTOMOTIVE MANUFACTURER

COMPANY CONCERNS

Automotive assembly is a complex operation which makes the tracking, handling, and disposal of process wastes difficult. Hundreds of small waste generation points are spread over a vast area, making the control and consolidation of potentially recyclable wastes a very difficult task.

With the assistance of an ON-SITE worker, this company has made considerable progress in identifying and characterizing wastes, and in finding 4Rs solutions to waste management challenges. The company has hired the ON-SITE worker as a full-time environmental engineer.

4Rs ACTIVITIES

The first task which the ON-SITE project worker addressed was the implementation of the corporate waste identification program. The aim of this program is to identify point sources of waste generation, and to determine which wastes could be reduced, reused or recycled. The program is also designed to ensure the safe handling and disposal of wastes, and to ensure continuing regulatory compliance.

Progress towards 4Rs solutions was made in a number of areas.

Solvent Waste

Xylene is used in many locations throughout the plant as a cleaning solvent. The total amount purchased averages 25,000 litres per week. The company receives virgin solvent from its head office; it is difficult to quantify the amounts purchased for any given use because solvents are purchased for both production and non-production uses.

Approximately 20,000 litres/week of used solvents are sent to Anachemia for recycling, at a cost of 10 cents/litre. The remaining 3,200 litres/week of solvent waste is taken by Tricil (at a cost of 19 cents/litre) because it is contaminated with paint sludge. The company buys back a significant quantity of reclaimed solvent from Anachemia. Information on specific quantities is unavailable.

The company would prefer to send all of its used solvents to Anachemia. At the time of writing, this was not possible because the contaminated solvent would have to be stored until it could be blended and recycled, and Anachemia did not yet have a receiver number to do this. If Anachemia could store the contaminated portion, they would blend it with compatible wastes to produce other desired end products.

The company has considered installing an on-site distillation system, but space constraints have put this plan on hold. There are plans to study the economics of off-site versus on-site solvent recovery, but this study has not yet been completed.

Spray Booth Paint Sludge and Waste Water

Paint sludge is generated from conventional spray booths and water curtain booths. The waste from the spray booths has been reduced by 50% by reinserting paint from the booth filters back into the painting process. This is a proprietary process.

The booths now produce 14,000 litres of paint sludge per month; this is down from 28,000 litres per month. The company pays Tricil 37.5 cents/litre for the disposal of paint sludge, so the saving amounts to ($0.375 x 14,000) $5,250 per month or $63,000 per year.

The change in operations was suggested by one of the spray booth operators. This individual was given a citation for his idea through a corporate program which encourages employee input.

Until recently, the waste water from the water curtain booths was sewered. The company was informed by its municipality that it was not in compliance with sewer use bylaws, and has taken action to remedy the situation. The company will send water curtain booth wastes to a sister company within the city. This branch has a clarifier which flocculates out contaminants so that the sewered water complies with municipal guidelines.

Sealer Wastes

These wastes are produced from a variety of activities, but the two main sources are windshield mounting and unibody sealing operations. The ON-SITE worker observed the sealer operators' cleaning methods and realized that there was room for improvement.

Sealer guns are cleaned nightly with xylene. Xylene not only contaminates the sealer wastes, making recycling impossible, but it also forces a reclassification of the sealer waste as a hazardous waste. Currently, operators use xylene to remove all the sealer, and use one drum to hold xylene-contaminated sealer. The ON-SITE worker suggested adding a second drum to hold sealer which could be removed without solvents as the first step in a two-step process. The uncontaminated sealer waste could be sent back to the manufacturer for recycling. (The manufacturer cannot recycle xylene-contaminated sealer because the flash point is too low.) This suggestion has not yet been acted upon.

At this time, sealer wastes are being generated at a rate of 15 to 20 drums per month, which Tricil removes at a cost of $373 per drum. Changes in cleaning methods should reduce the amount sent to Tricil by 50% (annual savings of between $33,570 and $44,760).

The company is also investigating alternatives to xylene. One possible alternative is "Socpac", a water soluble, biodegradable substance which would pose fewer occupational health and safety concerns. More study of solvent alternatives is required.

Storage Building

The company plans to build a waste storage facility to ease plant space constraints. Plant engineering is proposing a 6,000 square foot building which will feature a concrete pad with four sumps, steel racks to hold drums, and a roof. The building, which will cost approximately $500,000, will enable the company to accumulate specific types of solvents, oils and sealers in sufficient quantities to make segregation and on-site recycling economically viable. The storage building also advances the possibility of on-site solvent recovery by providing space for the necessary equipment.

Water Consumption

Water uses were identified, the amount consumed at each work station was monitored, and the amount of water actually required was calculated. The ON-SITE worker discovered that employees were using far greater volumes than necessary. Most of the water was consumed for cleaning purposes, and then sewered without treatment.

In order to control discharges and reduce consumption, a ban was placed on sewering rinse/wash waters. By making employees more aware of their water use habits, and by banning the sewering of rinse and wash waters, there has been a 50% reduction in plant water consumption. The remaining 50%, oily water wastes, are now being drummed and shipped to Tricil for disposal.

Cardboard and Pallet Recycling

A municipal ban on the landfilling of cardboard began January 1, 1989, and the company initiated its cardboard recycling program as a result. At this time, twenty 40 cubic yard containers are being collected by Domtar Recycling Inc. each day. Weights of collected cardboard are unavailable at present.

Recyclable cardboard comes from small and large boxes, and from boxes which are attached to pallets. Collection bins have been placed around the plant, and a rule has been established which says that the last person to handle cardboard is responsible for depositing it in the container. Plant employees feel that the program is working well.

Small and large boxes are taken away by Domtar at a price of $45 per tonne. If these were baled and strapped, Domtar would pay between $65 and $75 per tonne. The company is now planning to purchase its own baler.

The company is also looking for a pallet recycler. They are currently sending 100 pallets a day to landfill, but the municipal ban on cardboard also extends to pallets. The company was given an extension until March so that they would have time to locate a recycler. The company has been negotiating with a broker who would take the cardboard box/pallets and separate them for recycling.

Company officials were confident that they would be recycling their wood waste by the March deadline.

WASTE MANAGEMENT RESEARCH QUESTIONNAIRE

PART ONE: GENERAL INFORMATION

Name: (C9)
Title: Environmental Engineer
Company:
Address:
# of Employees: 600
Principal Products/Services: Automobiles

Type of Waste & Quantities: Solvents, Paint Sludge, Adhesive Wastes
Type of Disposal: Off-site Recovery, Landfill, Incineration

1. What sources of information on environmental and waste management **regulations** does the company use (e.g., in-house expertise, consultants, provincial government, etc.)?
Region Consultants

2. What sources does the company turn to for information on **technologies** for the reduction of wastes and emissions (e.g., in-house expertise, consultants, provincial government, etc.)?
Region, Consultants

3. How many engineers are on staff at the plant site? ~20

Of these, how many have the time and mandate to work on controlling wastes at the plant (other than the ON-SITE worker)? 0

4. a. How many other staff with some technical training have the time and mandate to work on controlling wastes? 0

b. Briefly describe their qualifications and roles in the company.

c. Does the company make use of waste management consultants?

✓ Yes ___ No

If yes, how often (full-time, part-time, once-only) PART-TIME

If not, why not? _____

5. What potential does the company think the various waste management approaches have for this plant?[1]

Reduction	___ Good potential	✓ Some potential	___ No potential
Reuse	✓ Good potential	___ Some potential	___ No potential
Recycling	✓ Good potential	___ Some potential	___ No potential
Recovery	___ Good potential	✓ Some potential	___ No potential
Treatment	___ Good potential	✓ Some potential	___ No potential
Disposal	___ Good potential	✓ Some potential	___ No potential

6. Does the company give the "4Rs" priority when looking at waste management solutions?

✓ Yes ___ No

7. Would the company be willing to pay more for a "4Rs" solution than for treatment and/or disposal?

✓ Yes ___ No

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[1] Terms are defined as follows.
Reduction: not producing the waste in the first place, e.g., through process control or redesign, chemical substitution
Reuse: using a waste material, e.g., plastic regrind, again in its original form
Recycling: separating a waste material at source and reusing it, in the same process or in a different process
Recovery: removing materials from the mixed waste stream for sale or use off-site
Treatment: treatment on-site before discharge or disposal

4Rs CASE STUDY: G7

HEAVY TRANSPORTATION VEHICLE MANUFACTURER

COMPANY CONCERNS

This company, a manufacturer of heavy transportation vehicles, employs some 2,200 workers. A Canadian arm of a multinational, it is being influenced by a comprehensive "cradle-to-grave" waste management program initiated by its American parent company. If a solid or liquid industrial waste is generated by any of this corporation's plants, the new corporate policy is that the corporation is responsible for the appropriate and secure transportation, treatment and final disposition of the material.

In keeping with this philosophy of comprehensive generator responsibility, preference is given to reducing wastes and to on-site management of any wastes that are produced, rather than off-site incineration or landfill. Participating in the ON-SITE program was just one part of the Canadian affiliate's 4Rs efforts.

4Rs ACTIVITIES

Paint and Solvent Wastes

A total of 30,000 litres of paint and solvent wastes are produced annually during the production of different items in different locations. These were being sent for incineration off-site, and the company wanted to investigate 4Rs alternatives that would give them more control over their wastes.

The company approached a number of solvent recyclers to cost out off-site recycling of the spent solvent and paint wastes, and selected Varnicolor to haul and recycle the wastes. The wastes are collected in 1,000-litre containers that were placed at the various paint booths and mix rooms where the wastes are generated. At the time of writing, these containers were being rented from Varnicolor at a cost of $30/container/month. The company also invested $750 in a special funnel to enable proper draining of paint cans to ensure that all the waste liquid was recovered.

This system is still being fine-tuned, and the number and location of the containers may be adjusted. The company is also aware that employee training may be necessary to ensure that the recyclable wastes are properly source-separated. Information on overall costs and benefits was not available, but the savings are really secondary from this company's point of view. The main concern was to increase their control over this waste stream, in accordance with the corporate waste policy.

Oily Wastes
Approximately 15,000 litres of used machine lubricants and cutting oils, wasted fuels, spilled lubrication oils and maintenance drainings are generated annually. At one time, these wastes were being sent off-site for incineration, but they are now sent to an off-site rereclaimer. Information on costs and savings was not available.

Dissolved Air Flotation (DAF) Sludges
Approximately 270,000 litres of oily dissolved air flotation (DAF) sludge is generated by the company's in-house waste water treatment facility annually. At one time, this sludge was classified as an industrial liquid waste, and the company sent it to a rerefiner for recycling.

However, changes to Regulation 309 classified DAF sludges from metallizing processes as a hazardous waste. Although the company has completed extensive analyses of its DAF sludge and determined that it is acceptable material for recycling, the hazardous classification of this waste forces the company to incinerate rather than recycle it.

Solid Nonhazardous Wastes
For some time, scrap metals have been recovered for recycling. At welding and metal working stations, scrap metal is placed into totes. When the totes are filled, they are transported to a marshaling area in the shipping department to be loaded and hauled away by a scrap metal broker. Since the scrap contains a number of metals and is contaminated with other solid waste remnants such as wood, paper, etc., the company receives a low price from the broker.

To reduce this mixing and contamination of currently recycled materials, and to improve the prospects for recycling other materials, the ON-SITE worker designed a facility "sorting station". This station would accommodate all 1,500 tonnes of solid waste (including wooden pallets, packing materials, cafeteria waste, etc.) generated by the plant each year. All nonhazardous solid wastes would pass through the front of the sorting station building to determine if they could be sorted for recycling. The single point of access to this facility would help to keep waste streams separate and minimize contamination of recyclable streams.

Such a facility would allow wastes to be sorted and stockpiled, in order to maximize recycling opportunities and revenues. Preliminary costing indicates that an investment of $50,000 would be required for the sorting station building itself, $150,000 for a shredder, $90,000 for a compactor, and $42,000 for other equipment. An initial company "guesstimate" suggests a payback period of about four years; this should improve if the proposed 66% increase in municipal tipping fees is implemented. More detailed cost and feasibility studies are now being carried out.

Wooden Pallets

The ON-SITE worker identified two methods to reduce the number of wooden pallets being sent for disposal. The proposed sorting station could provide a means of separating pallets out of the waste stream. Some pallets could be reused, and some could be sold or given to local industries.

Alternatively, to avoid creating this waste at all, the company could encourage its suppliers to ship materials on the company's own more durable plastic pallets. These could be provided to the suppliers free of charge, but subject to a $25 deposit. The company is considering the two alternatives in more detail.

Aluminum Soft Drink Cans

The company is about to implement a soft drink can recycling program throughout its facility. Large containers will be placed in cafeterias and near soft drink vending machines to encourage source separation. The company expects to recover a minimum of 100,000 aluminum cans per year.

Precise cost/benefit estimates were not provided. However, given the high volume-to-weight ratio of aluminum cans, the main savings are expected in waste transportation costs rather than landfill tipping fees. A small amount of revenue should also be generated from the sale of the aluminum.

Fine Paper

The company is studying the possibility of implementing a fine paper recycling program if this proves to be economically viable.

Purchase of Hazardous Waste Services

As part of the corporate cradle-to-grave waste management policy, this company audited all contractors which handled wastes leaving their plant. They are now satisfied that they have found qualified transporters and receivers whose use will reduce their corporate liability. Only those haulers, recyclers and disposers who meet the company's standards will be used. The company will reinspect and evaluate their haulers and receivers on an annual basis.

WASTE MANAGEMENT RESEARCH QUESTIONNAIRE

PART ONE: GENERAL INFORMATION

Name: (G7)
Title: ENVIRONMENTAL CO-ORDINATOR
Company:
Address:
# of Employees: 2200
Principal Products/Services: LOCOMOTIVES & MILITARY VEHICLES
Type of Waste & Quantities: OILY WASTES (1000 l/day); PAINT & SOLVENT WASTES (1000 l/day); SOLID NON-HAZARDOUS WASTES (5 T/day); WARM PROCESS WATER. INCLUDING DAF SLUDGE
Type of Disposal: RECYCLE; INCINERATION; LANDFILL; MUNICIPAL SEWER.

1. What sources of information on environmental and waste management **regulations** does the company use (e.g., in-house expertise, consultants, provincial government, etc.)?
ALL AND MORE - INCLUDING UNIVERSITY COURSES & HEAD OFFICE COURSES; A LARGE NUMBER OF PERIODICALS; SEMINARS; CASUAL MEDIA INPUTS; AND TRADE CONTRACTORS.

2. What sources does the company turn to for information on **technologies** for the reduction of wastes and emissions (e.g., in-house expertise, consultants, provincial government, etc.)?
ALL AND MORE - INCLUDING HEAD OFFICE CORE GROUPS; PERIODICALS; SEMINARS, MEDIA; TRADE EXPERTS VIZ. CONTRACTORS & CONSULTANTS

3. How many engineers are on staff at the plant site? ~ 100

   Of these, how many have the time and mandate to work on controlling wastes at the plant (other than the ON-SITE worker)? 1

4. a. How many other staff with some technical training have the time and mandate to work on controlling wastes? 1

   b. Briefly describe their qualifications and roles in the company.
FIRST CLASS POWER HOUSE OPERATORS HANDLE WASTES - MANAGER (POWER HOUSE) HAS CONSIDERABLE INPUT

c. Does the company make use of waste management consultants?

✓ Yes ✓ No

If yes, how often (full-time, part-time, once-only) AS NEEDED FOR SPECIFIC PROJECTS

If not, why not? MANAGEMENT FEEL "IN-HOUSE" EXPERTISE IS ADEQUATE.
(OWNS CORPORATION – WORLD SCALE CONSULTANTS).

5. What potential does the company think the various waste management approaches have for this plant?[1]

Reduction	__ Good potential	✓ Some potential	__ No potential
Reuse	__ Good potential	__ Some potential	✓ No potential
Recycling	__ Good potential	__ Some potential	✓ No potential
Recovery	✓ Good potential	__ Some potential	__ No potential
Treatment	__ Good potential	✓ Some potential	__ No potential
Disposal	__ Good potential	✓ Some potential	__ No potential

6. Does the company give the "4Rs" priority when looking at waste management solutions?

✓ Yes ✓ No

7. Would the company be willing to pay more for a "4Rs" solution than for treatment and/or disposal?

__ Yes ✓ No

THERE IS ALWAYS THE POTENTIAL THAT TO APPEAR AS A GOOD CORPORATE CITIZEN IT MAY BE WORTHWHILE – WHICH IS A MANAGEMENT DECISION! USUALLY ECONOMICS DICTATE ANY ACTION, AND IS NORMALLY BASED ON REDUCING OR CONTAINING COSTS IN AN INCREASING COST ATMOSPHERE.

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[1] Terms are defined as follows.
Reduction: not producing the waste in the first place, e.g., through process control or redesign, chemical substitution
Reuse: using a waste material, e.g., plastic regrind, again in its original form
Recycling: separating a waste material at source and reusing it, in the same process or in a different process
Recovery: removing materials from the mixed waste stream for sale or use off-site
Treatment: treatment on-site before discharge or disposal

METAL FABRICATING

4Rs CASE STUDY: C18

PACKAGING MANUFACTURER

COMPANY CONCERNS

This firm produces aluminum and steel soft drink cans. Before the ON-SITE worker's arrival, the company had received a proposal from an engineering firm to undertake an extensive study of the company's waste management needs. However, since the consultants' fees alone for the proposed study would be $300,000, and since the company felt that the proposal did not adequately address their needs, they decided not to hire the firm. Instead, they have been analyzing their waste situation using in-house resources and with the assistance of an ON-SITE worker.

4Rs ACTIVITIES

Waste Oils

The plant produces two types of waste oils: a coolant for the ironers and crankcase oil from production machinery.

Ironer Waste

Ironers are used to ensure that the rolled aluminum or steel is flat before it is cut and shaped. The oil used as a coolant is emulsified in water (at a ratio of 1:1). This water gradually becomes contaminated with metals.

In 1983, acting on the recommendations of a U.S. affiliate, the company purchased an ultrafiltration unit manufactured by Ramicon Inc. of Woodburn, Massachusetts, a division of Rohm and Haas. This system separates contaminated water from the cooling oil, which can then be reused.

This system, which has a holding capacity of 2,000 gallons, increases the oil:water ratio to 17:3. Clean water is then added to this mixture to bring the oil:water ratio back to 1:1 so that it can be reused as coolant. Water recovered from the ultrafiltration system is pumped into a holding tank, flocculated with a combination of aluminum hydroxide and sodium hydroxide, pH controlled, then sewered. Solids are filter pressed and sent to Tricil Limited for disposal.

Although this system is meant to be self-cleaning, it should be cleaned regularly. Having understood that the system was self-cleaning, this company had not been regularly cleaning it. The lack of cleaning has meant that the system has achieved a lower rate of recovery than specified in its performance guidelines (80% instead of 90% efficiency). The company is now undertaking regular cleaning of the system.

Since the cooling oils are recycled several times, the system has considerably reduced the amount of oily water waste requiring disposal. The company now

disposes of eight drums of oily wastes every month, rather than 24 per month, as was previously the case. New oil purchases are 66% lower.

Future plans call for an assessment of the Ramicon system, to determine how well the system is meeting the company's current and future needs. The company would like to recycle as much of the oily water water in-house as possible.

Crankcase Oils

Crankcase oils are changed every month, producing 15 drums of waste per month. These oils cannot be reused in-house because their viscosity is too low. The company pays $0.35 per gallon in disposal costs, plus $80 per hour in handling charges.

The company has switched from drum storage to bulk storage of oily wastes to reduce handling and transportation costs. The storage tank holds 1,000 gallons and cuts the handling time from an average of four hours to 1.5 hours. At $80 per hour for handling charges, this saves $240 per visit, and $1,000 per year, yielding a payback for the storage tank of two years.

Solvent Waste

The company uses four solvents in large quantities: isopropyl alcohol, methyl ethyl ketone, heptane and toluene. Solvents are used as cleaners and thinners. The company generates 2,600 gallons of waste solvent per month and disposes of them at a cost of $2.86 per gallon.

The company bought a small distillation unit over five years ago to segregate the four types of solvents, but it is completely inadequate for the plant's requirements. The still processes only one drum of poorly segregated solvents every 24 hours, and is not self-cleaning.

Company management is very leery of discussing other solvent recycling alternatives, given their experiences with this system. In addition, the solvents currently used by the company have boiling points which are incompatible with distillation; that is, some boiling points are very close together, others are very far apart. However, the company is still interested in investigating the feasibility of purchasing a larger, self-cleaning still.

The company currently stores waste solvents in an underground storage tank. Recent legal action taken in the U.S. against firms which had leaky underground storage tanks has persuaded the company to decommission this tank and replace it with an aboveground tank in the spring of 1989.

Paint Sludge

This waste is produced from paint overspray, especially on the conveyor which carries the containers through the spray booths. The conveyor lines are greased so that the paint buildup does not impede conveyance, and so that the water-soluble overspray is easier to remove.

The company now produces five drums of pumpable and eight drums of non-pumpable paint sludge every month; these cost $28 and $180 per drum to dispose of, respectively. The pumpable sludge contains 70% solvent, the non-pumpable wastes consist of the grease/paint buildup from the conveyors.

As a short-term solution, the ON-SITE worker suggested combining the pumpable sludge and the non-pumpable streams either manually or automatically to make the combination pumpable. This would be a simple process to initiate since both streams are produced simultaneously. Combining the sludges would result in a waste disposal savings of $1216 per month ($152 per drum x 8 drums). These suggestions are currently under review.

Process Change to Powdered Coatings

Early estimates show that up to 85% of the paint solvents currently used could be eliminated if the company switched to powder coatings. Currently, the company uses 60 types of coatings and 40 types of inks; since only the coatings would be replaced if the company switched to powder coatings, the solvents used as ink thinners would still be used.

Over the last few years, the U.S. Food and Drug Administration (FDA) has approved some types of powder coatings for use on the inner liners of food containers. The ON-SITE worker feels that the company is now in a position to reevaluate their use of solvents and coatings, given recent changes in the U.S. FDA. The company is currently examining costs and investigating relevant Canadian regulations.

Preliminary investigations indicate that if the company switched to a powder system, the cost of coating 1,000 cans would be $2. However, this cost does not include the costs associated with changes to production processes. By contrast, the cost of coating 1,000 cans using the current solvent-based system is estimated at $0.25. However, this cost does not include the cost of solvent disposal.

The company must complete considerably more research before a decision can be made regarding the feasibility of using powder coatings.

Sealant Waste

Small amounts of sealant waste are generated from the process of sealing can seams. This substance is considered a hazardous waste because of the presence of 1% ammonia. A maximum of three drums per months are removed at a cost of $125 per drum.

The company plans to assess the applicability of a small membrane filtration system to concentrate the solid portion of the sealant waste; the high proportion of water present makes this a logical solution.

WASTE MANAGEMENT RESEARCH QUESTIONNAIRE

PART ONE: GENERAL INFORMATION

Name: (C18)
Title: WHMIS AND WASTE MANAGEMENT CO-ORDINATOR
Company:
Address:
# of Employees: 300
Principal Products/Services: PRODUCTION OF VARIOUS TYPES OF BEVERAGE AND AEROSOL CANS
Type of Waste & Quantities: WASTE OIL, SOLVENTS, PAINT SLUDGES AND CAN COMPOUND
Type of Disposal: HAULED AWAY BY DISPOSAL FIRM FOR INCINERATION AND/OR RECYCLING

1. What sources of information on environmental and waste management **regulations** does the company use (e.g., in-house expertise, consultants, provincial government, etc.)?
SOURCES OF INFORMATION ARE USED FROM WITHIN THE COMPANY WITH HELP FROM GOVERNMENT OFFICERS.

2. What sources does the company turn to for information on **technologies** for the reduction of wastes and emissions (e.g., in-house expertise, consultants, provincial government, etc.)?
IN-HOUSE EXPERTISE AND CONSULTANTS.

3. How many engineers are on staff at the plant site? 2

Of these, how many have the time and mandate to work on controlling wastes at the plant (other than the ON-SITE worker)?
0 - They co-operate

4. a. How many other staff with some technical training have the time and mandate to work on controlling wastes? 1

b. Briefly describe their qualifications and roles in the company.
PLANT MANAGER - HAS WORKED ALONE WITH CONSULTANTS AND IS KNOWLEDGEABLE OF COMPANY OPERATIONS - HAS ALSO THE MANDATE TO CONTROL WASTES

c. Does the company make use of waste management consultants?

✓ Yes ___ No

If yes, how often (full-time, part-time, once-only) PART-TIME

If not, why not? _____

5. What potential does the company think the various waste management approaches have for this plant?[1]

Reduction	___ Good potential	✓ Some potential	___ No potential
Reuse	___ Good potential	✓ Some potential	___ No potential
Recycling	___ Good potential	✓ Some potential	___ No potential
Recovery	___ Good potential	✓ Some potential	___ No potential
Treatment	___ Good potential	✓ Some potential	___ No potential
Disposal	___ Good potential	✓ Some potential	___ No potential

6. Does the company give the "4Rs" priority when looking at waste management solutions?

✓ Yes ___ No

7. Would the company be willing to pay more for a "4Rs" solution than for treatment and/or disposal?

✓ Yes ___ No

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[1] Terms are defined as follows.
Reduction: not producing the waste in the first place, e.g., through process control or redesign, chemical substitution
Reuse: using a waste material, e.g., plastic regrind, again in its original form
Recycling: separating a waste material at source and reusing it, in the same process or in a different process
Recovery: removing materials from the mixed waste stream for sale or use off-site
Treatment: treatment on-site before discharge or disposal

4Rs CASE STUDY: P1

ELECTROPLATER

COMPANY CONCERNS

This company electroplates auto parts. Its new management has stated a commitment to upholding its environmental responsibilities, but the company is currently on shaky financial ground. This situation has resulted in labour problems, which is turn have led to poor housekeeping, waste treatment, and product manufacturing practices.

Two years ago, the company purchased a waste treatment system for their plating bath rinse water, which contains heavy metals, primarily zinc. Unfortunately, the company did not have access to technical expertise when they bought the treatment system. Had they been able to consult a technical authority, they would have avoided the problems encountered with their present system. Indeed, they would probably have purchased a recovery system instead of a treatment system.

Instead, in 1986, the company purchased an "Alkafloc" system from ACG Technology of Mississauga. The Alkafloc handles 20 gallons of waste water per minute, and operates as follows (see attached diagram).

1) A neutralization tank which uses caustic soda and sulphuric or hydrochloric acids is used to raise pH levels to between 9 and 10, because the polymer floc used by the company performs best at this range. (Note: the name of the polymer floc is proprietary information).

2) A clarifier which uses the polymer floc captures solids. Filter plates angled at 55° capture solids which escape the polymer floc. A pump draws the sludge to a tank below.

3) Sludge is then allowed to settle, fluids are drawn off, and the solids are filter-pressed and drummed for disposal. Two drums of solids are produced by the system each week.

4) Waste water is emptied into a pH adjustment tank . After leaving the clarifier, the waste water should contain less than 5 ppm of zinc.

Before the ON-SITE worker's arrival, the system had performed erratically. Low levels of zinc were achieveable (2 parts per billion), but fluctuations in zinc levels were common. The system required a good deal of maintenance, and the pH of the final adjustment tank was too high (usually between pH 8 and 10).

As a result of work undertaken by the ON-SITE worker, the zinc levels are less variable, the system polymer performs more effectively, and a solution has been proposed to address the high pH problem.

WASTE MANAGEMENT ACTIVITIES

Aeration Problems

The ON-SITE worker (who is now the company engineer) analysed the treatment system to find out why it was perfoming erratically. He discovered that air bubbles were being carried into the clarifier from the neutralization tank; these bubbles were impeding the performance of the polymer. Second, bubbles formed during a reaction between the caustic soda and acid were also hampering the polymer's performance. Third, the engineer believed that oil drag out from the parts being plated was being carried into the rinse waters.

To address the first problem, the engineer installed a second check valve at the base of the neutralization tank. Normally, the waste water would travel through a check valve from one tank to the next, but the valve can plug up and put stress on the pump, making the latter a prime source of air infiltration. The second check valve acts as a safeguard. Further, valves are now cleaned and maintained more often. The check valves and regular maintenance have reduced the system's aeration problems.

Equalization Tank

In the long term, the engineer is proposing that an equalization tank be installed between the neutralization tank and the clarifier in order to slow the flow of liquid through the system and control excessive agitation. A slower flow rate will result in less stress on the pump, less plugging in the check valve, and more efficient polymer performance. By using a spare in-house tank, the company could make this improvement while spending very little money. However, no decisions have been made at this time.

pH Adjustment

One final problem with the Alkafloc system is that the pH adjustment tank is not sufficiently large to hold water for the length of time required to lower the pH below 8. The company engineer has suggested that the company buy a larger tank; this proposal is being considered.

Filter Press

The engineer discovered that the system's filter press was too small for the demands placed upon it. He has proposed that the company purchase a larger press; this suggestion is under review.

Plating and Rinse Tanks

The plating and rinse tanks are now so old that iron is leaching from them into the baths. The iron can be treated by the treatment system because its properties are similar to zinc; however, this means that more polymer floc has to be used. The question of tank replacement will have to addressed soon because the tanks are so old that they will soon begin to leak.

4Rs PLANS

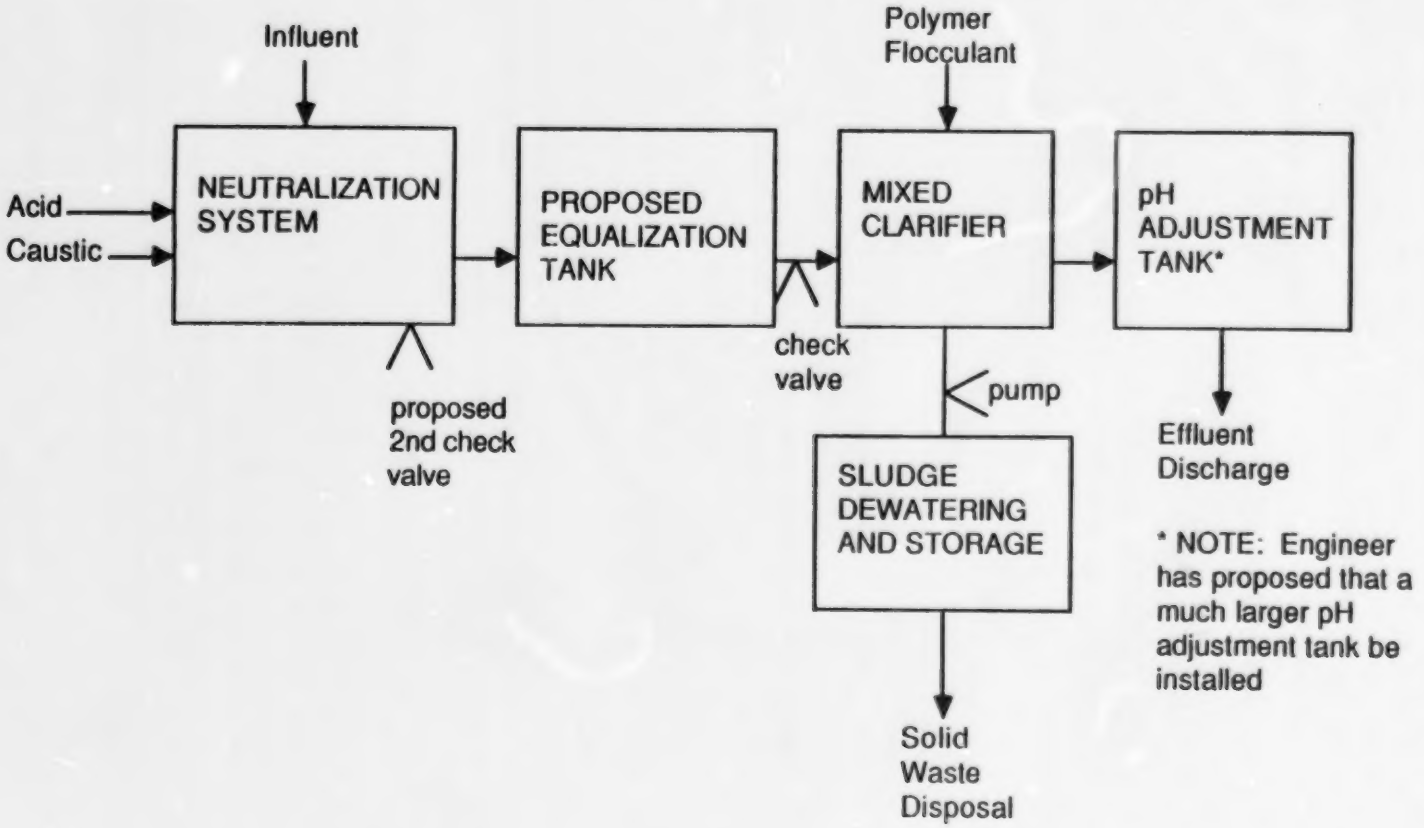
In the two years since the system has been installed, the company has spent in excess of $88,000 in capital, upgrading and maintenance costs. Thanks to the engineer's analysis, the company now recognizes that they should have purchased a recovery system in the first place. With the advent of stricter sewer use bylaws, company officials will have to decide whether to merely upgrade the system to be in compliance or whether to purchase a recovery system.

The company engineer has researched ion exchange and evaporation systems which compare favorably with the current system. Both systems have good zinc recovery potential and would result in material cost and waste disposal savings. The company will consider payback schedules before it decides which system it should invest in.

Finances permitting, the company would also like to set up their own lab to analyze samples for monitoring purposes. This would be preferable to the current practice of sending samples to their chemical supplier every month and waiting for results. In addition, they would reduce their chemical usage, improve their bath chemistry, and have fewer rejects since more immediate results would allow faster action to correct problems.

This company is in the midst of clarifying its financial situation. Waste management proposals will be priorized and acted upon as finances allow.

FLOW DIAGRAM OF PLATING BATH RINSE TREATMENT SYSTEM



WASTE MANAGEMENT RESEARCH QUESTIONNAIRE

PART ONE: GENERAL INFORMATION

Name: (P1)
Title:
Company:
Address:
# of Employees: approx. 30
Principal Products/Services: electroplating

Type of Waste & Quantities: zinc in effluent, solvents

Type of Disposal: user off-site.

1. What sources of information on environmental and waste management **regulations** does the company use (e.g., in-house expertise, consultants, provincial government, etc.)?
   MOE, CONSULTANTS

2. What sources does the company turn to for information on **technologies** for the reduction of wastes and emissions (e.g., in-house expertise, consultants, provincial government, etc.)?
   A.C.G. TECHNOLOGY, CONSULTANTS

3. How many engineers are on staff at the plant site? NONE

   Of these, how many have the time and mandate to work on controlling wastes at the plant (other than the ON-SITE worker)? —

4. a. How many other staff with some technical training have the time and mandate to work on controlling wastes? —

   b. Briefly describe their qualifications and roles in the company.

c. Does the company make use of waste management consultants?

✓ Yes ___ No

If yes, how often (full-time, part-time, once-only) PART-TIME

If not, why not? _____

5. What potential does the company think the various waste management approaches have for this plant?[1]

Reduction	___ Good potential	___ Some potential	___ No potential
Reuse	___ Good potential	___ Some potential	___ No potential
Recycling	___ Good potential	___ Some potential	___ No potential
Recovery	___ Good potential	___ Some potential	___ No potential
Treatment	✓ Good potential	___ Some potential	___ No potential
Disposal	___ Good potential	___ Some potential	___ No potential

6. Does the company give the "4Rs" priority when looking at waste management solutions?

___ Yes ✓ No

7. Would the company be willing to pay more for a "4Rs" solution than for treatment and/or disposal?

___ Yes ✓ No

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1 Terms are defined as follows.
Reduction: not producing the waste in the first place, e.g., through process control or redesign, chemical substitution
Reuse: using a waste material, e.g., plastic regrind, again in its original form
Recycling: separating a waste material at source and reusing it, in the same process or in a different process
Recovery: removing materials from the mixed waste stream for sale or use off-site
Treatment: treatment on-site before discharge or disposal

GENERAL MANUFACTURING AND SERVICES

4Rs CASE STUDY: D17

ROOFING PRODUCTS MANUFACTURER

COMPANY CONCERNS

This company produces roofing products, specifically asphalt shingles and roll goods. These are manufactured by passing a cellulose roofing felt (supplied by an affiliated company) through a saturation process, in which the roofing felt absorbs approximately 1.7 times its own weight of the asphalt saturant material. The saturated material is then coated on both sides with a mixture of coating asphalt and limestone. Mineral granules of specific colour are applied to the surface, while talc is applied to the reverse side of the product. The material is then cooled, cut or rolled into specific sizes, packaged and then shipped or stored.

Approximately 11,600 tons of roofing material were being wasted every year at this facility. This included off-spec and damaged materials that were returned to the affiliated supplier company for recycling, and wastes which had to be disposed of in some way.

When the company took on an ON-SITE worker, it was particularly interested in studying areas of production where materials were being lost, in order to establish possible reduction options.

4Rs ACTIVITIES

The ON-SITE worker became involved in three waste reduction projects: installing a mineral granule waste recovery system; reducing the amount of asphalt loss which occurred during unloading; and improving a talc application and dust collection return system.

Mineral Granule Waste Recovery System

In 1986, a company study showed that raw material was being lost due to "spill-over" of granules off the asphalt sheets as the sheets looped through a series of cooling rolls on their way to being compressed in a press roll. A recovery system had been put in place at one time, but it had been gradually dismantled as it wore out.

The company decided to move the press roll to the beginning of the cooling system, an approach that is taken in other roofing plants in North America. A new press was purchased for $23,000 and installed during December 1988. It is estimated that the granule waste will be reduced by 50% (from 1,400 tonnes/year to less than 700 tonnes/year.) The company expects to save $50,000 in raw materials and $7,000 in landfill tipping fees annually. At this rate of savings, the purchase and installation costs will be recovered in approximately six months.

In addition, the company is investigating a recovery system for the one cooling roll which immediately precedes the press roll. Losses from this roll are believed to be substantial: prior to the installation of the new press roll, this lone roll had accounted for 50% of the mineral granule losses.

Asphalt Lost During Unloading
When trucks unload asphalt, they hook up a flexible hose which is connected to a pump inside the plant. Some of the asphalt sticks to the sides of the line and causes blockages in the line and pump.

These blockages, when cleaned out of the line, are currently treated as a waste. At one time, the hose was connected to a simple pully system. When disconnected, the end of the hose was lifted so that the asphalt could drain back into the pump. However, the pully broke down and was not repaired, so that the end of the hose now drains into an empty 20-litre pail.

The ON-SITE worker has suggested to the company that the pulley system be repaired so that the asphalt can be drained back and reused. He estimated that the costs would be minimal, and that the savings from improving the asphalt unloading system would be at least $15,000 ($7,500 in recovered asphalt raw material, $7,000 in costs for 20-litre pails, and $500 in avoided landfill tipping fees). The company is considering this suggestion.

Talc Application and Dust Collection/Return System
In 1986-87, new ductwork and an overfeed return system were added to the plant's dust collection/return system to address the problems of material loss (two tonnes of talc were being swept up each day and later landfilled) and the occupational health and safety concerns associated with the inhalation of silicate dust, a talc ingredient. However, the new components were improperly designed and have not alleviated the problems.

After investigating several options, the company decided to purchase a new type of talc which is made of coarser material, and produces less dust. Less dust not only means less waste and better health and safety conditions: since less of the new talc is lost as dust, there is a saving in raw material costs. In addition, the new talc is 22% cheaper.

The company is also planning to redesign the dust collection/return system in 1989. Estimated savings from recovered talc will be approximately $4,000 per year. With the introduction of the coarser, less expensive talc, a further savings of $45,640 is expected in the area of material purchase alone. The payback should be between one and three years.

Felt Waste Reduction
In 1989, the company began purchasing larger rolls of organic felt to reduce material shipping costs. It has found that the larger rolls have other benefits as well: fewer splices are necessary, and less felt is wasted due to superficial damage during shipping and handling. In addition, since the production line

does not have to be shut down as often to change rolls, breakage of material and production of scrap are minimized.

Although the waste felt was recycled by the supplier company, reducing the waste at-source is an even better solution, and one which is higher on the "waste management hierarchy".

WASTE MANAGEMENT RESEARCH QUESTIONNAIRE

PART ONE: GENERAL INFORMATION

Name: (D17)
Title: On-Site Project Worker
Company:
Address:
# of Employees: 106
Principal Products/Services: Asphalt Shingles & Roll Goods

Type of Waste & Quantities: Solid: Roofing Waste, 11,600 tons/annually
Liquid: Oil/Water Mixture,
Type of Disposal: Solid: Municipal Landfill, Liquid: Off-site oil recovery by recycling company(then sold)

1. What sources of information on environmental and waste management **regulations** does the company use (e.g., in-house expertise, consultants, provincial government, etc.)?
Government, Trade Literature, In-House Expertise usually through corporate head office.

2. What sources does the company turn to for information on **technologies** for the reduction of wastes and emissions (e.g., in-house expertise, consultants, provincial government, etc.)?
Trade Literature, In-House Expertise, Government

3. How many engineers are on staff at the plant site? 5
2-Foremen, 1-Plant Engineer, Plant Manager, Production Superintendent
Of these, how many have the time and mandate to work on controlling wastes at the plant (other than the ON-SITE worker)?
This is a composite number from those that can spare the time to be DIRECTLY involved. 1

4. a. How many other staff with some technical training have the time and mandate to work on controlling wastes? NONE

b. Briefly describe their qualifications and roles in the company.
N/A

c. Does the company make use of waste management consultants?

___ Yes X No

If yes, how often (full-time, part-time, once-only) N/A

If not, why not? Up until now, the landfill tipping fees were so low(and actually still are), that this was economically unnecessary. But with the large amounts of waste involved, it has become evident that this trend is starting to change.

5. What potential does the company think the various waste management approaches have for this plant?[1]

Reduction	X	Good potential	__	Some potential	__	No potential
Reuse	__	Good potential	X	Some potential	__	No potential
Recycling	__	Good potential	X	Some potential	__	No potential
Recovery	__	Good potential	X	Some potential	__	No potential
Treatment	__	Good potential	X	Some potential	__	No potential
Disposal	X	Good potential	__	Some potential	__	No potential

6. Does the company give the "4Rs" priority when looking at waste management solutions?

X Yes __ No At present the plant is in a turn-around phase with new management and engineers, and these priorities are becoming more relevent.

7. Would the company be willing to pay more for a "4Rs" solution than for treatment and/or disposal?

X Yes __ No

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[1] Terms are defined as follows.
Reduction: not producing the waste in the first place, e.g., through process control or redesign, chemical substitution
Reuse: using a waste material, e.g., plastic regrind, again in its original form
Recycling: separating a waste material at source and reusing it, in the same process or in a different process
Recovery: removing materials from the mixed waste stream for sale or use off-site
Treatment: treatment on-site before discharge or disposal

4Rs CASE STUDY: W3

RECYCLING SERVICE COMPANY

COMPANY APPROACH

This is a new company which specializes in materials recycling from small generators. Its approach is to audit manufacturing plants, shopping malls, or hospitals for potentially recyclable materials and then recommend the recovery of materials which are economically viable for recycling. The underlying assumption which directs the company's activities is that the chief criterion for recycling is an economic one: to be attractive, recycling cannot cost a client more than disposal.

In most cases, recycling is now less expensive than disposal, so the company has no difficulty in attracting clients. The difficulties occur when clients are asked to change their waste management habits. However, given the current recycling atmosphere, clients are now more willing to change their operations, and they take less time to do so than in years past. According to the company, as early as one year ago, it would have taken months for a company to make a decision regarding a recycling initiative; now it takes weeks. Rising landfill tipping fees are an added incentive for change.

The company uses an integrated approach to selling their services; they sell balers and shredders and provide bins for material collection as well as providing analysis, advice and brokerage services.

The most lucrative materials for recycling are OCC, plastics and wood, but the company does broker other materials. The company uses the most valuable material at a given location to subsidize the collection of less valuable materials. For example, the return from a large volume of OCC may enable them to collect a small volume of plastics, or a large volume of plastics might make the collection of wooden pallets worthwhile.

OCC

Because there is so much competition for OCC at present, there is no need for generating companies to use a middleman; they can sell this material directly to Domtar Recycling Inc. or Atlantic Packaging Inc. Consequently, this company must offer extra services (such as those noted above) to attract generators.

Company representatives feel that banning OCC from landfills would not be as productive as increasing tipping fees because the increased revenue from tipping fees could be used to develop recycling technologies for currently non-recyclable OCC types (e.g., waxed OCC or box board).

The company believes that the OCC market is quite stable. Ontario is a net importer of OCC from the U.S. Because it is cheaper to recycle OCC than to import it or to produce it from virgin pulp, there is a demand for waste OCC from

Ontario's generators. The company feels that rumours of a deflating market can be traced to end users, for whom the lowest market price is desirable. The company believes that end user companies like Domtar and Atlantic want to keep prices down in order to offset increasing transportation costs. These have risen from $10/ton in 1986 to $34/ton in 1989, mostly due to traffic congestion in southern Ontario. Trucks now take longer to travel a given route.

Plastics

The company's strategy is to concentrate on the small generator of waste plastics because other brokers are looking only at large generators. They are able to offer plastics recycling services to small generators by tying them in as part of a larger package. The company deals almost exclusively in PET and HDPE, but they have brokered plastic films in the past.

Finding end users for plastics is not difficult; the problem is finding an end user who will pay for the material. Plastics prices are highly variable; the higher the base price of the plastic, the more flexibility the recycler has. PET prices vary from $80 to $220/ton; HDPE fetches a maximum of $500/ton (baled material only).

Wood

The company deals with traditional wood end users -- that is, pallet recyclers and companies which shred pallets and other wood wastes. The company deals almost exclusively in pallets.

According to this company, more end uses or products for wood wastes are needed. This would give potential wood recyclers the ability to offer small generators the economic incentive to recycle their wood wastes. The company feels that the lack of end uses has slowed the development of a wood recycling market. As a result, there aren't many wood waste recycling operations in existence.

The company has identified and developed a proprietary end use product which it hopes to be able to produce soon, in order to offer a market for waste wood. This end use requires a sufficient feedstock (minimum of 5,000 pounds per day) of ground wood. The company is currently costing out a central grinding facility to keep handling and transportation costs as low as possible. This company maintains that such a facility is required to make the venture profitable, otherwise it is easier and less expensive for companies to burn wood wastes instead of recycling them.

WASTE MANAGEMENT RESEARCH QUESTIONNAIRE

PART ONE: GENERAL INFORMATION

Name: (W3)
Title: RECYCLING AUDITOR
Company:
Address:
# of Employees: 5
Principal Products/Services: BALERS, SOLID WASTE BROKERS
Type of Waste & Quantities: NONE
Type of Disposal:

1. What sources of information on environmental and waste management **regulations** does the company use (e.g., in-house expertise, consultants, provincial government, etc.)?
   MOE, INDUSTRIAL ASSOCIATIONS

2. What sources does the company turn to for information on **technologies** for the reduction of wastes and emissions (e.g., in-house expertise, consultants, provincial government, etc.)?
   MOE, INDUSTRIAL SUPPLIERS

3. How many engineers are on staff at the plant site? 0

   Of these, how many have the time and mandate to work on controlling wastes at the plant (other than the ON-SITE worker)?
   0

4. a. How many other staff with some technical training have the time and mandate to work on controlling wastes? 0 - SEE BELOW

   b. Briefly describe their qualifications and roles in the company.
   ALL EMPLOYEES PROVIDE WASTE MANAGEMENT ADVICE AND GUIDANCE.

c. Does the company make use of waste management consultants?

___ Yes _X_ No

If yes, how often (full-time, part-time, once-only) _____

If not, why not? INHOUSE CAPABILITIES ARE SUFFICIANT

5. What potential does the company think the various waste management approaches have for this plant?[1]

Reduction	✓ Good potential	__ Some potential	__ No potential
Reuse	✓ Good potential	__ Some potential	__ No potential
Recycling	✓ Good potential	__ Some potential	__ No potential
Recovery	__ Good potential	__ Some potential	✓ No potential
Treatment	__ Good potential	__ Some potential	✓ No potential
Disposal	__ Good potential	__ Some potential	✓ No potential

6. Does the company give the "4Rs" priority when looking at waste management solutions?

_X_ Yes __ No

7. Would the company be willing to pay more for a "4Rs" solution than for treatment and/or disposal?

_X_ Yes __ No

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[1] Terms are defined as follows.
Reduction: not producing the waste in the first place, e.g., through process control or redesign, chemical substitution
Reuse: using a waste material, e.g., plastic regrind, again in its original form
Recycling: separating a waste material at source and reusing it, in the same process or in a different process
Recovery: removing materials from the mixed waste stream for sale or use off-site
Treatment: treatment on-site before discharge or disposal